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A Weekly Review of Current Progress in Electricity and its Practical Applications

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Vol. VII. NEW YORK, MAY 1, 1886. No. 18.

AN article in this issue on the Denver telephone exchange shows that exchange management admits of the display of much ingenuity in adapting the service to the conditions involved, and in finding out methods of quick and economical operation. With all the tendency to uniformity of system, it is evident that the telephonic field still offers ample room for individual skill and inventiveness.

SENDING sketches over a wire by the ordinary Morse method of telegraphing might, at first thought, seem improbable, but reference to another column will show in what manner it can be accomplished. This fac-simile method, if it may be called such, will probably find its principal application for purposes of war, being, indeed, the outcome of the independent labors of two military men. By its means, plans of the enemy's fortifications or positions might be quickly transmitted to headquarters from the front, and preparations made accordingly. The Signal Service Corps of our army might with profit take up this system, which could be made available also for the transmission of weather charts. We believe that a somewhat similar method has been applied to telegraphing graphically the scores in shooting matches.

WE publish in this issue the conclusion of Mr. David Brooks' interesting historical sketch of the development and perfection of insulators for overhead wires. The information he gives will be new to many of our readers. One great lesson derived from his review of the subject is the desirability of unremitting experiment and the advantage of having a quick perception of the meaning of small and apparently trivial details.

SOME interesting notes on current electrical events in England are given by one of our foreign correspondents in this issue. It appears from one paragraph that the Delaney synchronous multiplex system of telegraphy has found favor in the eyes of the practical officials of the Postal Telegraphs, and is to be put in operation on three or four important circuits. England furnishes good conditions for the success of the system.

THE flexibility of electric lighting systems has induced ingenious and enterprising persons to make some very novel experiments in illumination, but no scheme has ever been bolder than that now to be carried out at the Paris International Exhibition. It is proposed to build a tower nearly 1,000 feet in height and to display at the top an arc light that will be visible 200 miles away. The idea is not a bad one, and the tower is likely to earn a good income if provided with balconies at various points and passenger elevators.

THE cable rate war, now just commencing, promises fairly to be a war of extermination. The Mackay-Bennett Company seems to have so cut into the Gould system that the latter has turned and intends now to see which can best stand the fight. It will be an up-hill job for Mackay and Bennett—as it is for any one who locks horns with Jay Gould—for, while the two gentlemen named must needs fight with their own funds, Jay Gould can fight with somebody else's money, and when he wants more he can levy assessment after assessment on the stockholders.

REPORTS come from Washington that it is proposed to reorganize the corps of examiners in the Patent Office. There are twenty-four principal examiners at $2,400 each, twenty-eight first assistants at $1,800 each, twenty-eight second assistants at $1,600 each, thirty third assistants at $1,400 each and thirty-five fourth assistants at $1,200. There are some half-dozen ladies in the lower grades of examiners. It is said that the scheme involves a readjustment of divisions and duties and an improvement in the scale of pay. The time is ripe for some such reform. The Patent Office at present offers little inducement to able men to stay in it as examiners, and the consequence is that the personnel is always changing, to the detriment of the work. Besides, the existing force is not able to keep up with its task of looking into five hundred new patent cases every week and disposing of them properly.

IN giving the description of a well-designed plant for the electro-deposition of metals (page 203), Mr. Slater bewails the fact that so few books furnish what is called "practical information" on electro-metallurgical operations. This is the old complaint of the "practical" man who neglects books because they do not enter into the minutest details contributing to successful operation. While Mr. Slater himself does not come under this category, he nevertheless voices undoubtedly the opinion of a great many strugglers in this art as well as in others; but this does not lessen the value of books by any means. After all, practical information can only be obtained by actual practice, and the province of a book on any of the arts is that of a guide-post which points out the correct road, but leaves the traveler to take it and to encounter and remove for himself all the small obstacles found on the way. Hence, while books cannot take the place of actual experience, their value, as embodying the experiences of others must not be ignored, and nothing can be more useful to the really practical man, than a good library, if used intelligently, as a means of suggestion and inspiration.

AT the time of the appointment of the Electrical Subway Commissioners for this city, the remark was current among electricians that in all probability the commissioners would be under ground before the wires were. The recent death of Mr. Loew gives painful point and emphasis to what was only intended as an exaggerated way of stating the belief that the wires would stay on the poles longer than the public generally expected. And now that occasion arises for the appointment of a new commissioner, we do not find any greater anxiety than before in civic circles to have a competent electrical expert appointed, who might be expected to see the great work attempted and carried out in a systematic and scientific manner. On the contrary, the various political bodies are pressing for recognition the claims to the office of men, good no doubt in their own line, but who have not the least conception of the requirements of the case, and who are therefore from the start wholly dependent upon advice in the matter, and may be sadly misguided. It is said that Governor Hill now has 40 names of candidates under notice and desires to select an electrician.

OUR readers will have noticed that Mr. Bernstein in his paper introduces the word "strain" to signify the reciprocal of the number of watts required for every candle-power of light emitted. While "efficiency," the term now employed to signify the number of watts per c.-p. required by the lamp is open to criticism, on account of the nonconformity with its signification when used in connection with other matter, the introduction of a new word open to the same objection seems unwise, in these days of too much uncertain electrical nomenclature. Leaving out of the question the consideration whether it be desirable to do away with the word "efficiency" in this connection, we think that Mr. Bernstein has fallen into a common error in applying the word "strain" as he does. Many persons employ the words stress and strain indifferently to signify the forces which are applied to bodies. Properly applied, however, the word stress alone has this signification, the strain being the kind of alteration in form produced by a stress. Hence it would appear that Mr. Bernstein has made a bad selection for his new term, as evidently no change of form is implied in the electrical definition of the new term. We do not know whether the new word will be accepted or not; but if it appears desirable to revise our nomenclature let it be a sound revision, and not one open to criticism, as many of the old terms are.

WHEREVER the presence of a steam boiler and engine is objectionable, the electric motor should reign supreme; but the public is not yet educated up to the full appreciation of its merits. We make this statement, laying the burden upon the public, because no reasonable doubt exists any longer as to the fact that the electrical engineer is competent to solve practically any problem of the electrical transmission of power over moderate distances. Our description of an electric crane recently put in operation in France proves this again, and shows that, especially in traveling cranes, the electric motor will be the source of power. In the present instance a steam boiler and its fire were inadmissible on account of the danger from fire in the midst of cotton bales, and the work of hoisting had heretofore to be performed by manual labor. We believe that a law prohibiting the placing of steam boilers on the wharves in New York harbor has prevented the installation of any permanent hoisting apparatus upon them, and the hoisting at present is accomplished almost exclusively by donkey engines upon the ships, or by the aid of horses. The danger from fire is the ruling consideration, but with the current led to an electro-motor, the stevedores would be independent of the ships. It might be well for those interested in electric motors to study this particular application. We are confident that a good design will meet with favor among the shipping interests in this city, as well as among the owners of manufacturing establishments where heavy pieces are constantly handled.

THE great activity in electric lighting and the brisk demand for apparatus are well exemplified by the increase in the number of manufacturing or parent companies. In this line, as in any other, the speculative element is found, but on the other hand, there are concerns with a national reputation entering the field to compete for actual business on the basis of merit. So noteworthy has the activity become of late that hardly a month, or even a week, has passed when our pages have not contained the illustrated description of some new system. Aside, however, from the commercial aspect of the matter, a comparison of the various forms of apparatus shown cannot fail to be both interesting and instructive, as each design, whether it be of a lamp, a dynamo, or a switch is, as a rule, modeled on different lines from those of any other, although the fundamental principles consulted may be the same. With due regard to the importance of mechanical details, perhaps the best preparation for intelligent and critical observation of the kind suggested is a study of the theory underlying the construction. We shall no doubt be met in this assertion by the old argument that the "practical man" has done as good work as the theorist, and it is true; but it is unwise to lose sight of the countless unnecessary trials and experiments originating in the lack of theoretical knowledge and in ignorance of what others have accomplished. The force of this remark is evidenced by the numerous communications we receive requesting information on points that are the subject of exhaustive treatises or asking for definite rules on other points that allow of the widest latitude; showing often that the correspondent is working on a wrong basis and will lose time as well as other valuable things. To such, a "little" theory would be of incalculable benefit, and he who has ambition enough to undertake original construction ought by no means to neglect that which must lie at the foundation of all good work. Where theory and practice are combined in one man, the most brilliant results follow; but the combination is rare and epochal.

How to Wind the Magnets for Shunt, Series and Compound Machines—VII.

BY CARL HERING.

Compound Machines, Continued.

Having found this position and marked it, the test for determining the ampère windings may be made as above described, the results being the required exciting current for each different number of lamps to bring the machine to its desired potential. This current multiplied by the number of windings of the temporary coils gives the numbers of ampère windings required for supplying a constant potential to a varying number of lamps.

Having made all these adjustments and the series of measurements for determining the ampère turns for different numbers of lamps, it is advisable, though not absolutely necessary, to make the other test for determining the magnetic curve, as was described for shunt machines.* It is more necessary to do this in the case of compound machines than for either shunt or series, as it enables one to see up to what limit the machine may be made to have a constant potential, and also to see whether it is practicable to attempt to make it compound at all. If there is any doubt about its being well proportioned for a compound machine, it is best to make this test first, in order to save the trouble of the other test in case the proportions are found to be too bad for a compound machine. How to improve the proportions from the results of this test will be discussed later.

From the results of this test for the relation between the useful magnetism and the ampère windings, lay off the values of the potential on open circuit and the magnetizing ampère windings as abscissas and ordinates, respectively, and draw the curve through the points in the same way as described for shunt machines. If the machine is properly proportioned, this curve should be two tolerably straight lines connected by a short, curved line, as *a b* in Fig. 5. As the ampère windings must, from the nature of the compound winding, increase in direct proportion to the current of the machine, it is evident that the machine may be made compound only on one or the other side of the curved part *c d* of the line *a b;* that is, for the curve represented here, the extreme number of ampère windings must be equal to or less than that for the point *c*—that is, equal to or less than *h i;* or the smallest limit must be equal to or greater than that for the point *d*—that is, *d e*. It cannot possibly be made to have a constant potential for a number of ampère windings lying between *c* and *d*, except, perhaps, approximately for a very short range, if the curve is not a sharp one. As the point *c* designates the point at which the magnet cores are just being saturated, it will evidently be more economical to run the machine between the points *a* and *c*, rather than between *d* and *b*, for it will then require less energy in the magnets, and, therefore, also less wire, as the amount of thick wire (series coils) will be very much less for points below *c* than for points above *d*, as is evident. If the curve is not even approximately straight at one of the two parts, it is not advisable to attempt to make the machine self-regulating with a constant potential without adjusting the brushes, except for very small ranges of the varying load. In general, the straighter this curve below the saturation point *c*, the more nearly can the machine be made to have a constant potential.

Having made this examination and found the maximum limit to the number of ampère turns, take the results of the test first described, for determining the ampère windings required for supplying the same potential to different numbers of lamps, and construct a curve from the values obtained, by laying off the current in the armature as abscissas, and the required number of ampère windings as ordinates, plotting the points and drawing a line through them. This line will be somewhat like the curved line *g f* in Fig. 5, and may for the sake of direct comparison be drawn on the same sheet with the other curve, by taking the abscissas as ampères instead of volts. The line *c k* representing the permissible limiting value for the ampère windings, shows, by its intersection *h* with the curve *g f*, the extreme number of ampères *h k* or *i o*, for which the machine may be made self regulating. The line *g n* shows the smallest number of ampère turns which will ever be required (on open circuit), and, therefore, by its intersection with *a c* at *n* shows the limiting portion *n c* of the curve *a c*, which is in actual use. If this part of the curve *a c* (which, under good conditions, will be very small), be straight, or nearly so, the machine may be made self regulating, even if the rest of the curve *a b* is very much curved. This portion *n c* may be made quite small by making the armature resistance very small and making the number of turns on it small, as will be seen later.

It may be remarked here, that if the test had been continued for a greater number of lamps than that which is represented by the distance *o i*, the curve *g h* would have been found to curve upward like *h f*, due to the fact that the magnets are being saturated. The machine can be made self-regulating only for the tolerably straight portion of the curve *g f*. Furthermore, if *n c* is curved considerably, *g h* will also be so in about the same proportion and in the same direction.

To calculate the number of ampère windings which must be allotted to the shunt and to the series coils, draw a straight line *g h* through the curved line *g h*, making it coincide more nearly with those portions of the curve which represent the numbers of lamps which will be used most frequently with that machine. For instance, at *g* the curve will probably deviate most from the straight line, but it is not necessary to consider that part of the curve, as the machine will probably seldom be used for such a small number of lamps.

The vertical distances to this straight line *g h* represent the ampère windings which can be supplied by a winding consisting of series and shunt coils, and is, therefore, the nearest approach possible with such a winding to generate the ampère windings required by the curved line *g h* obtained from the test. The more this straight line deviates from the curved one, the greater will be the deviation of the potential from the desired constant value.

From the position of this line the proportion of the series and shunt coils is calculated as follows. As to the vertical distance representing ampère turns, it is evident that these distances are made up of a constant part *g o* and a regularly increasing part lying between the lines *g p* and *g h*. It is evident, therefore, that the shunt coils, in which, as was described, the current is approximately constant for any number of lamps, must supply the ampère windings represented by *g o*, and the series coils must supply the constantly increasing portion.

Up to this point it is immaterial which of the two methods of winding is to be used. In many cases it will make so little difference whether the long shunt or the ordinary method is used, that the same calculation will answer for both. Furthermore, if it is not necessary to make the machine regulate automatically as accurately as it is possible to make it, then certain corrections may be neglected, in which case also the same calculation will answer for both methods.

The conditions under which the following calculation can be used for both cases are as follows: If the machine is large; if the relative armature resistance is small; if the proportion of energy required in the magnets is not too large; if the shunt current may be comparatively

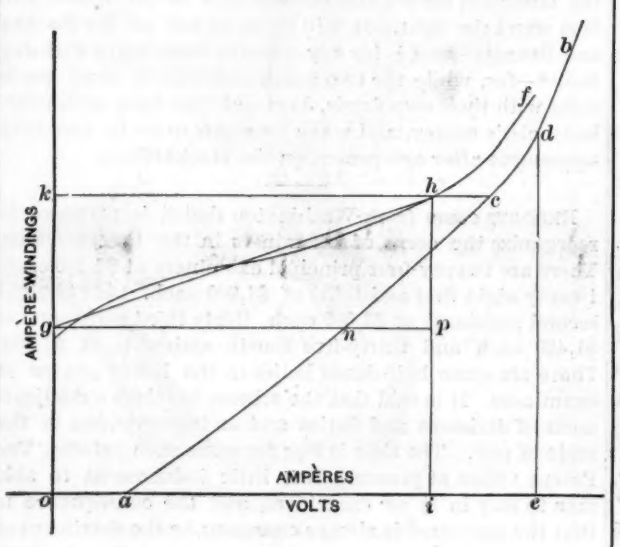


FIG. 5.

small; if the brushes may be shifted slightly to adjust; if an adjustable resistance in the shunt circuit may be used within small limits; if the magnets are not over saturated; if the speed is not quite constant, thus necessitating hand regulation.

Under these conditions the following approximate method may be used. The shunt coils are calculated the same way as for an ordinary shunt machine from the number of ampère windings represented by the distance *g o*, the only difference being that the current is a smaller proportion of the whole current than in ordinary shunt machines, as will be seen. The series coils are calculated as follows: For a current in the armature represented by *o i* the ampère windings must be increased by an amount represented by *h p* ampère windings in addition to that supplied by the shunt magnets. As this same current *o i* flows through these series coils as well as in the external circuit, it is evident that the number of windings of the series coils must be this number of ampère windings represented by *h p*, divided by the current represented by *o i*. The number of windings thus obtained will evidently be the same, no matter what the current supplied be, as it depends only on the angle *h g p*. The diameter of the wire must be calculated the same way as for a series machine, from the maximum current *o i*, and the allowable fall of potential, which in this case must be much smaller than in a series machine. In general, the whole allowable loss of energy for the magnets can be divided into two parts, which have the proportion which the distances *h p* and *p i* have to each other and to the whole distance *h i*, giving the series coils that part *h p* of the whole *h i*, and the shunt the rest. For instance, if *h p* is one-third of *h i*, then the series coils may absorb about one-third of the whole amount of energy allowed for the magnets and the shunt coils the remaining two-thirds. If 3 per cent. of the whole energy is allowed for the magnetization, then in this case the series coils may absorb 1 per cent. of the potential and the shunt coils 2 per cent. of the maximum current.

As will be noticed, this method does not take into account the fact that the loss of potential in the series windings should be replaced by an increasing potential at the armature; neither does it take into account that the shunt coil current should be subtracted from that in the external circuit and series coils. Therefore the potential of the finished machine, although approximately constant, will not be as much so as it would be possible to make it if we were to correct the proportions of the windings for the above mentioned losses. These corrections become all the more necessary, in fact sometimes quite essential, under the following conditions. If the machine is small they are essential. If the armature resistance is relatively high, that is, if the series coils supply a great part of the ampère windings, the correction for loss of potential is important; and if the magnets are over-saturated this correction generally becomes essential. If the required magnetization is relatively great, and the shunt current relatively large, the correction for this shunt current is important. In general, if the proportion of energy required by the magnets is large, both corrections become necessary. If constant speed can be maintained and it is required to make the machine have as nearly a constant potential as it is possible to make it, then both corrections should be made.

(TO BE CONTINUED.)

* ELECTRICAL WORLD, March 6, p. 106.

A New Accumulator.

In the new accumulator of Mr. Desmond Fitzgerald the negative plates are formed entirely of peroxide of lead in the form of hard slabs, so that the action takes place throughout the whole mass; suitable terminals of an inoxidizable material being provided for the slabs. This arrangement obviates the necessity of having perforated lead plates to contain the peroxide. It is stated that 16 ampère-hours are obtained from every pound weight of these plates. The positive element consists of spongy lead in a new form, which admits of the plates being bent or rolled without damage to them. Some 27 ampère-hours per pound weight are obtained from these. A one horse-power cell recently sent to Paris gave 10 ampère-hours, or 20 watt-hours per pound of plates; the total weight of the cell, everything included, being 75 lbs. Mr. Fitzgerald has also found that sulphate of magnesia, or Epsom salts, has a remarkable power of fixing peroxide in the "forming" process, and is greatly superior to the ordinary acid electrolyte. This reduces the first cost of the batteries considerably.

The Resistance in the Voltaic Arc.

According to Prof. Edlund, the apparent resistance of the voltaic arc consists, as it were, of two parts, one independent of the length of the arc, and the other proportional to it. Call this resistance r, the length of arc l, while a and b are two constants, then $r = a + b\,l$. This holds if current is constant while length of arc is changed. Of the constants b is less when the current increases, while a is almost independent of the strength of the current, and of the electromotive force of the source of electricity; it is only when this is so much diminished that an arc light is scarcely formed that the value of a becomes less. The question may be put whether this constant a represents a resistance of transition, which takes place at the surface of contact of the electrodes and the air, or whether it has its origin in an electromotive force, for the diminution in the strength of the current expressed by a might be explained by either of these assumptions. From previous researches he finds a represents an electromotive force in opposition to the principal current. Frölich came to the conclusion that either of the assumptions is reconcilable with these observations, though he seems inclined to think that the constant a represents an electromotive force as well as a resistance of transition. Frölich probably considers that a cannot be exclusively an electromotive force, for in this case it would have what, in his opinion, is the absurdly high value of 39 volts. Peukert has made a series of observations on this subject, in which the strength of the current varied from 10 to 30 ampères. He found that the apparent resistance of the luminous arc may be represented by the formula $r = a + b\,l$. If it be assumed that the constant a is an electromotive force, its value, according to Peukert, must amount to 35 volts, a value which appeared to him so high that he did not venture to assume that it could have its origin in an electromotive force, but that partly, at least, it represents a resistance of transition. From Edlund's previous investigations it follows that a is independent both of the magnitude of the source of the current and of its strength, provided this does not sink to the lowest limit in which a voltaic arc may be formed. In his first experiments on this subject he calculated a as an electromotive force, expressed in Bunsen elements. Seven successive experiments made with a current of 53 to 79 Bunsen elements gave the following results: $a = 24.416$; 25.962; 25.354; 20.951; 21.637; 21.483; 23.119; the mean of which is = 23.315. This holds when the light is produced between carbon points of the ordinary kind. If it be assumed that 1 Bunsen element is equal to 1.7 Daniell's, and that the latter is 1.08 volt, 1 Bunsen = 1.80 volt. If this number be multiplied by the mean in question, we obtain 41.97 volts. The mean of this number and of that found by Frölich and Peukert (39 and 35) gives 38.66 volts. The view that the constant a partly represents a resistance of transition is disproved by the investigations of Victor von Lang, who

succeeded in proving that the voltaic arc does contain a counter electromotive force which is equal to 39 volts. As this value of the counter force in the arc is almost equal to the value of the constant a above given, it follows that there is no resistance of transition in the voltaic arc, and that therefore the entire diminution of the strength of the current which results from the production of the arc light is caused by the resistance of the arc $b\,l$, and by the electromotive force contained in it.

Underground Cables for Philadelphia.

To illustrate the practicability of underground electric light circuits, the Electrical Department of Philadelphia has arranged to lay in that city 11,550 feet of electric light conductor in Broad street, from Columbia avenue to Lehigh avenue, a distance of nearly six thousand feet. About eight lights will be distributed in the distance named. The cable will connect at Columbia avenue with an aërial circuit already built. The whole circuit will include 50 to 60 lights of either the Thomson-Houston system or that of the United States Company.

The cable will be laid in the second week in May, in a spruce box 3 × 2 inches inside and filled in with pitch. In the same box and trench will be laid also one five conductor anti-induction cable, one mile in length, for city, fire, police, signal and alarm circuits. The contract for all the above cable has been awarded to the Standard Underground Cable Company, and the cable is now being made.

The New Quarters of the Electrical Department of Philadelphia.

The magnificent quarters of the Philadelphia Electrical Department in the new City Hall building are now in shape for occupancy and awaiting the placing of the instruments and apparatus. These quarters are of the most elaborate, commodious and complete character. The operating room is 51 × 47 feet with 30-foot ceiling and is handsomely finished in oak and cherry wood. Two hundred wires will be worked from this room, and the most convenient and complete arrangements for inside wiring have been made. On each side of the main room, and connecting with it, are large private offices for the use of Chief Walker and his assistants.

Large store and supply rooms are provided on the next floor, and above these is the battery room, 76 by 55 feet, with 30-foot ceiling, and finished in cherry and oak woodwork like the operating room and private offices.

Handsome oak stands are in place ready for the 1,500 cells of battery which are to be accommodated for the use of the fire-alarm and police circuits. The stands are provided with insulated feet, 6 inches high by 9½ inches, and each separate cell of battery rests in an insulated holder. The shelves are narrow and these cell-holders are set in position in holes in the shelves, somewhat as insulators are set in a cross-arm. The wires will be distributed through ducts in the floor, and these, after the wires have been connected, will be covered and sealed with asphalt flooring uniform with the rest of the floor.

The line wires will enter the building through a 6-foot brick conduit, 124 feet long, extending under the northeast corner of the building to the curb line. At that point a 20-inch iron pipe extends 85 feet out and 10 feet deep to a brick manhole, from which other 20-inch iron pipes extend east and northeast to two similar manholes, through one or the other of which all the wires will eventually be connected. The iron pipe conduits are asphalt-lined and a two-inch asphalted plank, rounded to fit, lies in the bottom of each.

The wires enter the operating room on the third floor through an arched duct 110 feet long and 31 inches wide under the floors, the bottom of which is of plate glass embedded in asphaltum, which provides a smooth, highly insulated surface for the wires.

In size and completeness and in the elaborate artistic finish of the rooms, as well as in the convenient, thorough and practical arrangements provided for the important circuits which will be operated, these quarters are beyond criticism.

Chief D. R. Walker and assistant and electrician Jno. C. Sager are much to be congratulated.

It is not expected that the final connections will be made before the end of August next.

The new City Hall building, of marble and granite, stands on the site of Penn Square, at the intersection of Broad and Market streets, covers four and a half acres, or more than four city blocks, and contains 520 rooms. The height of the main tower will be 437 feet 4 inches above the pavement, being 70 feet higher than the great Strasburg cathedral and within 113 feet of the height of the Washington monument.

The Waterhouse System of Electric Lighting.

We illustrate on this page the new system of electric lighting designed by Mr. Addison G. Waterhouse and controlled by the Waterhouse Electric and Manufacturing Company, of Hartford, Conn. The dynamo shown in the accompanying engraving, Fig. 2, is intended to generate the current for 20 arc lights of 2,000 c. p. As will be seen, the oval cast-iron base forms the cross connection between the lower ends of the field magnets, which form consequent poles and are bolted together at their contiguous points. The armature revolves in bearings fixed in two standards cast with the base, and is of the Gramme type. One of the distinguishing features of the machine is the very simple means employed for effecting regulation. This consists of a third brush placed in contact with the commutator and in electrical connection with one of the other two usual brushes. The position of all the brushes remains fixed, and by this means it is claimed any number of lamps can be switched on or out without causing a spark at the commutator. In this way, all regulating apparatus is dispensed with, the machine accommodating itself to every variation in the external circuit.

The lamps employed in connection with the machine are shown in Figs. 1 and 3. The mechanism separates the carbons, so as to give a long arc.

FIG. 1.

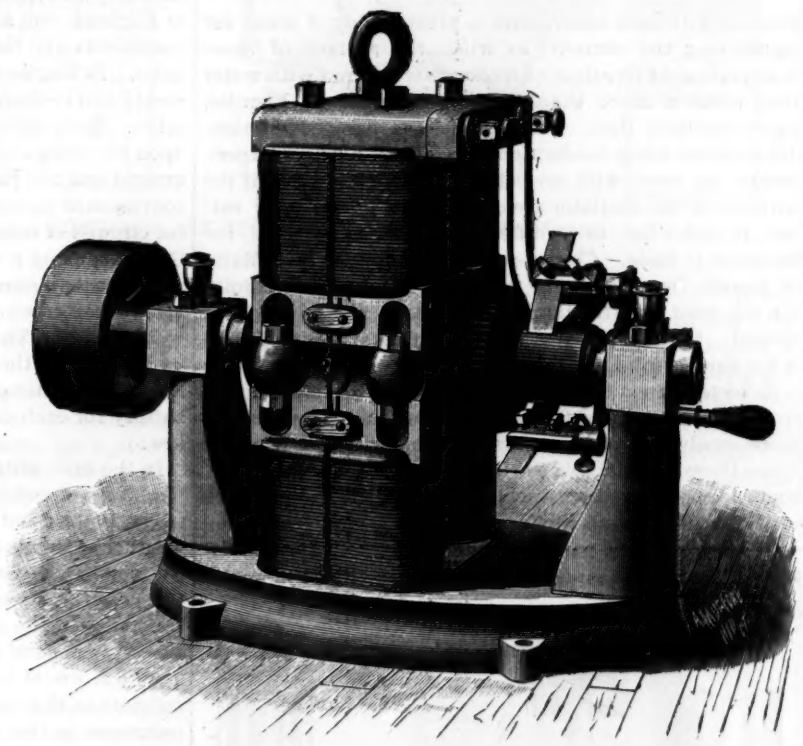


FIG. 2.

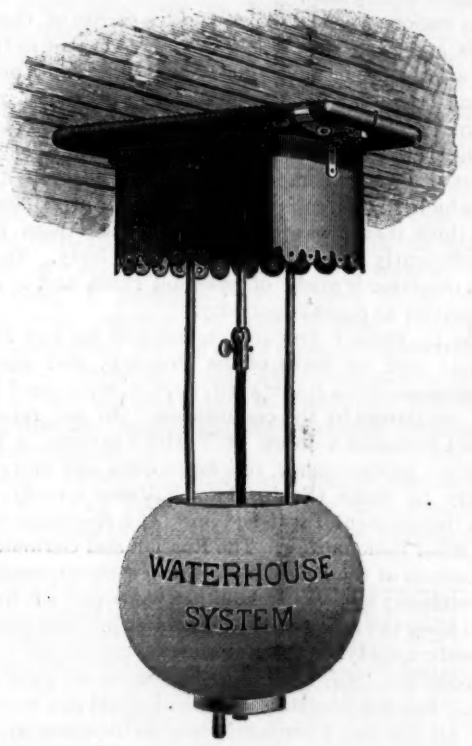


FIG. 3.

THE WATERHOUSE SYSTEM OF ELECTRIC LIGHTING.

"Wild-Cat" Telephone Companies.

J. E. Hockett, superintendent of the Central Union Telephone Company, thinks that various telephone prospects on foot in Indianapolis are of the "wild-cat" order. He says that there is no doubt that the Bell Company would bring suit against any one of them should it attempt to operate, and he makes bold to say that, in his opinion, these companies are seeking franchises of which to make merchandise. He may be charged, of course, with being an interested party, but he gives the following reasons for the faith that is in him. Taking up the several companies in detail, he says:

The Interstate Company, represented by Mr. Leach, claims to have the right to operate under a new patent, granted to George M. Hopkins; the company that attempted to operate under his older patents having been enjoined by the Bell Company. Mr. Leach did not, at the council committee meeting last Saturday, undertake to describe their new instruments, but from other sources I am informed they embody no application of principles of transmission that have not already been passed upon by the United States courts and adjudged infringements on the Bell. I understood him to say his company has a telephone exchange in operation at Grand Rapids, but I have telegraphic information from a prominent telephone man of Michigan that such is not the case, and am also informed that the Interstate has put out no telephones under the last patent, but, in common with the other companies represented at the meeting Saturday, has confined its operations to the formation of companies and inducing persons of means to become financially interested in them. Its new patents cannot, of course, be tested for infringement until instruments are put out and it is made liable to action.

The Cushman story is a remarkable one. He has no patent, has not applied for one, and certainly could not get it if he did, even if his story were true, as the invention has been publicly known for more than two years. The first suggestion to the scientific world of the possibility of the transmission of speech by electricity was made in 1854, and was then regarded as only the wildest kind of imaginative speculation, and it was not until 1861 that sounds were transmitted through a telegraph wire by electricity. Yet Cushman claims to have invented the speaking telephone in 1851, and kept the secret from the public, and in 1882, when the commercial value of the invention was well known, and the proof of his claims would have filled the world with his fame and his pockets with money, he, so he says, entered into an agreement with the Bell Telephone Company to withhold his claims for three years for $100 per month. The Cushman Company have no instruments in commercial use.

The Brown appears to be simply and only another form of the Bell hand telephone, and has had no suits for infringement, no doubt for the reason that none of the Brown instruments are in use.

The Wallace is operating a few sickly exchanges in Canada, where the Bell patents were declared void, because the Bell instruments were not manufactured in Canada, as required by the patent law there. The Wallace Company put in a few (two, I believe) sets of instruments in New York, and were promptly sued by the Bell for infringement, and the suit is now pending.

The West people did not attempt to explain their instruments (make-and-break), but I have since had an opportunity to examine them and, to all appearances, they are a rehash of appliances that have already been by the United States courts adjudged infringements on the Bell Company's patents. The West telephone has been put into commercial use nowhere, and, therefore, of course, has not been tested for infringement.

I believe some of these companies claim to transmit speech with a transmitting telephone that positively makes and breaks contact of the electrical circuit, but their exhibitions in that line are old tricks, familiar to any electrician who has considered the subject. They forget that that issue was raised in the McDonough interference in the patent office, and that the decision was that "a century of McDonough, no more than a century of Reis, would have produced a speaking telephone."

Killed While Watching the Storm.—A dispatch of April 17 from New Castle, Pa., says: Two women were killed by lightning about eight miles from this city yesterday afternoon. Mrs. Hogue and a lady who was visiting her were standing in the door of Mrs. Hogue's dwelling, watching the storm, when a sudden stroke of lightning killed Mrs. Hogue instantly and injured the other lady so severely that she died several hours later.

Insulating Overhead Wires.

BY DAVID BROOKS.

(*Concluded.*)

In 1876 the French government obtained insulators from nearly all the nationalities of Europe, for the purpose of galvanometrical tests in comparison with their own, with which they were not satisfied. These tests or trials were conducted by the *commission de perfectionnement*, of which M. Gaugain was chairman. The result of six months trials was the adoption of the Prussian insulator. Fig. 6 shows a section of this insulator and its support or bracket. Fig. 7 shows the French insulator then in use. Fig. 8 shows the present French insulator.

It will be seen that they gave the insulator the insulating properties, so far as form is concerned, but held on to their bracket and the two epaulettes or shoulders which disfigured the old insulator. They were of no use, and rendered the insulator much more difficult and expensive to make. The iron bracket or support was fastened to the pole by three wood screws.

The Prussian bracket is made all in one piece, and screws directly into the pole. It is very strong, of wrought iron, with three sides—triangular shape—with a knife-edge projecting upward. This is to prevent the drops of rain from dashing upward into the sheltered portion of the insulator.

The commission took notice of this feature, and made their support of sufficient length and uprightness to accomplish the same purpose.

Among the insulators exposed for trial in the yard attached to the storehouse and factory of the government were ten of the familiar glass-and-bracket, obtained from the Western Union Company, and ten of the Varley inverts, much used in England.

I was curious to learn the respective merits of these insulators and was shown the record. Lowest in the list was Varley's, and next in order was the American glass-and-bracket. Mr. Varley stated in his report on the Western Union Telegraph lines, written in 1867, that his was higher than the French in the proportion of eleven to one, but this was in comparison with the old French insulator, which was defective in form and porous. The body was so thick that it was impossible to bake them in the kiln sufficiently to completely vitrify the body. The new French insulator is made of splendid china and is a perfect insulator as regards porosity.

While in Paris I procured a dozen of the new French insulators and as many of the Prussian, and also two galvanometers from Ruhmkorff, such as were used in the test of insulators by the commission. On my return to London I procured a dozen of Varley's inverts, a Thomson mirror galvanometer, resistance coils, and everything necessary to make the insulator business a study. The French Government furnished me with specimen insulators of other nationalities. The Russian and German were modifications of the Prussian, but not with so much protected surface; and their fastenings were not so well devised to keep the inner surface dry in rain. This feature I have made a study.

In December, 1867, I began these tests in the yard of my factory. For the first three months I could get no deflection at all on the French. When on the glass on cross-arms I could get fifty thousand divisions or more. The earthenware inverts did not stand as high as the glass and pin. Mr. Culley in every edition of his book recommends the insulator to be so placed that the outer surface can be washed in rain. In the eighth edition he says: "The insulator should be fixed above, not under, the arm which carries it, for when placed underneath the portion which is covered by the arm does not get washed by rain."

Experimenting on this feature, I used to turn the English cross-arms and insulators upside down and found by this changed position they tested fully three times better than with the glass and pin in their natural position; but when both were in natural positions the glass and pin stood the highest, from the fact that the pin was longer and farther removed from the spattering of drops of rain.

We placed the English insulator with the iron bolts or supports in the cross-arm as low as the shoulder would admit them, and in the same manner with the glass and pin, the latter of which has an enlargement above the cross-arm giving the pin additional strength, but the greater length of the pin carried the glass three times as high as the English insulator. Turning the cross-arms over did not improve the glass and pin; the glass being so far removed from the cross-arm, the arm above was no protection, but in the English insulator it was a protection, especially to the inner cup, as may be seen from the representation of this insulator in Culley's book—or in Prescott's.

Curious to know what good was derived from washing the outer surface of the insulator by rain, I wound a wire round the bottom of the outside cup of a single insulator and wound another wire in the groove to see what resistance or insulation was obtained by the outer surface during these ablutions when insulation is most needed.

A perfectly clean Varley insulator tested in this manner does not show one-tenth of a megohm resistance. The long style of glass—or the one that has grooves for tie wire near the top of the insulator—shows even less resistance, although the glass does not present over half the conducting surface.

The Prussian insulator tried in this manner is very much less than the glass, and the French chinaware still less than the Prussian; and this is explained on the principle of the affinity or non-affinity of these different materials for moisture. The earthenware has what is known as a salt glaze, which has an affinity for moisture in the same manner as oil has an affinity for steel or glass. A drop of oil upon a pane of glass of ordinary size, laid in a horizontal position—if the glass is perfectly dry—will soon cover the whole surface, and in this manner a few drops of rain will soon spread all over the entire surface of the earthenware, and the earthenware surface is the first to show conduction. The moisture on the porcelain does not flow so rapidly, but remains upon the surface in isolated bodies. On the French china the moisture gathers in thicker isolated bodies, and still later begins to show conduction. On the earthenware the water runs freely and in thin body, and begins to drop from the bottom of the insulator sooner than on the others. When the globules of water become so broad upon the surface of the porcelain as to

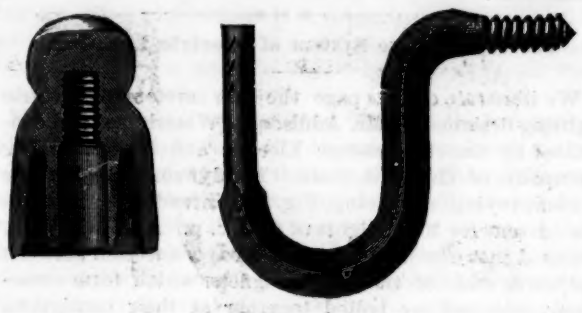


FIG. 6.

connect with each other, there is greater body of water for conducting the current; so when the surface of those materials most repellant of moisture is covered with water they conduct more than those less repellant. Ebonite, more repellant than china, and last to show conduction, drops lower when conduction takes place. These experiments are made with perfectly clean surfaces; but if the surfaces of the insulator are covered with smoke or carbon, it makes but little difference of what material the insulator is made. Clariat says, in speaking of the affinity of liquids for solids, "If the liquid has a greater affinity for the solid than the liquid has for itself, the solid will be wetted. If the liquid has a greater affinity for itself than it has for the solid, the solid will not be wetted."

Reflecting upon this law, I am reminded how nature covers the coatings of fish with a slime that they can the more easily move through the water without friction. Upon the same principle the bottoms of yachts and scull-boats are besmeared with soap to enable them the more easily to slip through the water.

Of all substances, paraffin is the most repellant of moisture. Testing the same outer surfaces of the Prussian in-

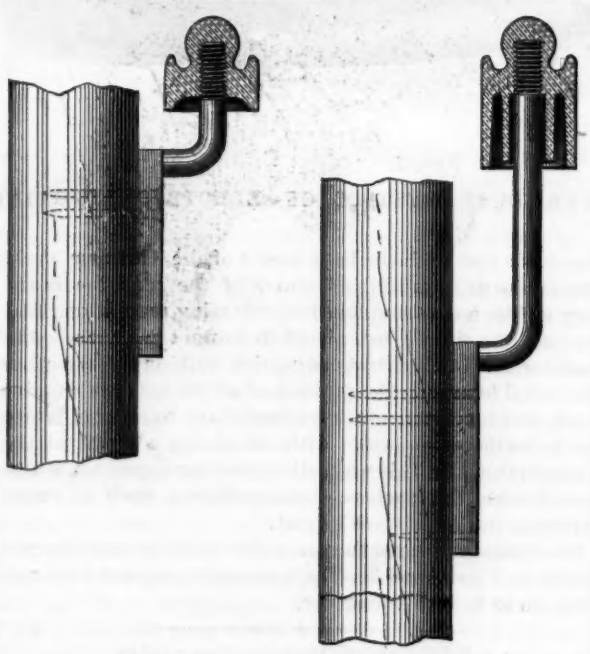


FIG. 7. FIG. 8.

sulator in rain, after the insulator had been dipped in paraffin, no deflection in the galvanometer could be obtained until it had been exposed four months. The water gathers itself in spherical bodies and drops off or rolls over the surface in the form of shot pellets. Exposed to the sun, dust and smoke, the paraffin in time lost this property.

In the Brooks insulator we placed this paraffin in the ceiling or upper portion of the protected inside surface, where it is least exposed to currents of air carrying dust and other impurities. The Brooks insulators show no leakage in rain until the inner portion is obstructed by insects, and then not till after an exposure of from four to six years.

The ingredients of the cement drives insects away for that period, but by removing the deposits in the shape of cocoons and webs, and rinsing the insulators in paraffine oil, their original insulating properties are restored. Insects never harbor inside of the common glass. They are never troublesome except when the insulator is made of an opaque substance, which hides them from the light. Taking advantage of this circumstance, I have shortened the shield of the cross-arm insulator so far as it is unnecessary to give the insulator strength. That portion below the cross-arm freely admits the light.

As to cement, Mr. Culley says sulphur splits the insulators, and I have referred to that fact in the fore part of this article. Sulphur, mixed with ten per cent. hard pitch, does not absorb moisture, and thereby expand. The pitch gives it adhesiveness, and the composition is an excellent insulator. Plaster of Paris and Portland cement much used are conductors, and thereby inferior as insulating cement.

The pitch and sulphur should be continuously stirred while in a melted state; on being worked otherwise, the sulphur, which is the heavier, will go to the bottom of the vessel.

The above is almost entirely in reference to the influence of rain and fog upon insulators, and the manner in which the effect can be obviated. There is no earthly reason why a line of telegraph should not work as well in hard rain as in a clear day. When it comes to absolute insulation, there is less escape in rain than in a clear, hot day, because all insulating substances are affected by temperature. The ordinary glass and pin is of a hundred times higher resistance in a clear, cold day of winter than in a clear, hot day of summer; yet there is no difficulty with the insulation in the hot day of summer, because the leakage, if the glass insulators are perfect, is too little to be shown in ordinary working.

The difference is best shown by the time the line will hold a charge.

I shall conclude this article with a few remarks on the economy and efficiency of good insulation. When you go to England, you are impressed with the large size of their conductors and the necessary weight and strain upon the poles. In England they used a No. 4 wire for what we would call ordinary circuits, say from one to two hundred miles. They use a battery for each wire and earth wire upon the poles and cross-arms to carry the escape to the ground and not pass to the other conductors and cause confusion of signals. As soon as you cross the channel, for circuits of equal length, you will find the French or Germans using a wire between ten and eleven gauge, or a wire less than one third the size and cost. Five circuits are worked from one battery, and they have no trouble in wet weather. They scarcely know when there is rain by its effect upon the insulation. There is no need of such heavy conductors, earth wires attached to the posts, or a battery for each circuit, unless the insulation is extremely low.

In the fifth edition of Mr. Culley's book, he states that, "taking a circuit better situated as regards insulation, between Belfast and Dublin (being out of the way of smoke), weather at Dublin damp, at Belfast dull, the insulation of a No. 4 wire is 91,900 ohms per mile." Taking such a line in this country, say one hundred miles in length, the insulation resistance of the entire line would be only 919 ohms, while the resistance of the wire itself is 550 ohms, and on a No. 7 wire it would be about 1,100. It will be seen that the insulators in the case of No. 7 wire would not show as much resistance as that of the wire itself. I do not believe it possible to work a wire by the American closed circuit system* under such conditions, yet Mr. Culley says in the margin under the head of remarks, "working well." He gives another instance of a No. 4 wire not so favorably located, giving an insulation resistance of 70,000 ohms per mile on a very wet day. Taking a No. 6 wire one hundred miles the insulators would not show as great a resistance as the wire itself.

The Pennsylvania Railroad Company have a special wire for reporting trains on each of their divisions of the main line. Each division is over a hundred miles in length, the middle division one hundred and thirty-five miles. On this division or circuit there are thirty-five relays, averaging one hundred and fifty ohms each, and the total resistance of the circuit is greater than that of a No. 4 wire a thousand miles long, or say, from New York to Chicago. Yet they have no difficulty in working this circuit on the American closed plan in the most humid or wet weather, but with ordinary insulation it would be impossible.

In 1867 Mr. Varley came to this country and made an examination and report of the condition of the Western Union lines. He states: "I tested nearly all the relays in 145 Broadway on January 23, 1868. They varied from 69 ohms to 1,205. The 69 ohm is where it should be on a long line, No. 2 to Chicago." One would naturally suppose that that statement contained a typographical error had he not soon followed it by another equally misleading, to wit: "By Ohm's laws the strength of a current is proportional to electromotive force divided by resistance." A 69-ohm relay is entirely out of place on a circuit of nearly a thousand miles. You could use a sounder of 5 ohms resistance instead of that relay and increase the strength of the circuit, but you get little or no magnetic effect. If the wire on the 69-ohm relay was one-half the size you would have double the length and twice as many turns or convolutions on the helices, making a slight allowance for the covering of wire.

* Which Mr. Culley says seems adapted only for well insulated lines of few instruments.

Doubling the length of the wire would fourfold its resistance. It would then have 276 ohms resistance. The total resistance of the circuit would be increased 209 ohms. If the length of line was 500 miles of No. 8 wire, at 13 ohms per mile, the total resistance of wire, instrument and battery would be in the neighborhood of 7,000 ohms. Adding the resistance, 209 ohms, necessary in changing the relay to one that gives twice as much magnetic effect, we increase the total resistance of the line about 3¼ per cent. By making the spools in the relay longer, we can still to great advantage increase the magnetic effect by using a still finer wire giving a greater number of turns; and carrying out this principle, the relays used in Germany, upon ordinary lengths of line, have over a thousand ohms resistance." But Mr. Varley went upon the principle that to make a line work in bad weather, you must use low-resistance relays and large wires or heavy conductors. To work a line with imperfect or extremely low insulation, low-resistance conductors and very strong batteries for each are necessary, while with proper insulation one-quarter of the battery power will work five such lengths of line of three times the resistance. It is done in Germany and France.

Carrying out this principle recommended by Mr. Varley, the Western Union Company have unnecessarily spent millions of dollars which could have been saved. The Prussian insulator and bracket cost about twenty-five cents; just as good porcelain is made in this country, both at Trenton, N. J., and Greenpoint, N. Y. Whether those potteries can mold them in the exact Prussian form, I am unable to say. I am told by intelligent operators that there are now three times the number of wires strung through the country that are necessary to do all the business when the weather is fine; but during hard rain business is very much delayed by defective insulation.

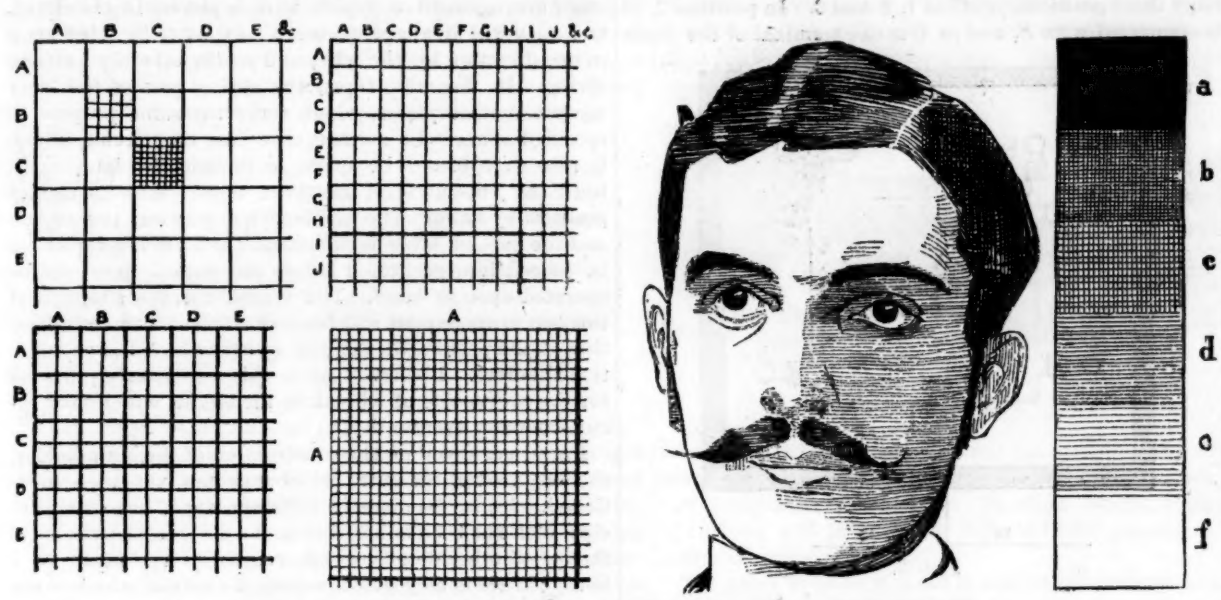
The greatest amount of moisture in the atmosphere is during rain and fog, with the ground covered with melting snow. Such a condition of affairs occurred in Philadelphia on Jan. 28, and in the Eastern States on the 29th. The New York *Herald* of Jan. 30, referring to the condition of the overhead wires, says: "Communication between Europe and this country would have been entirely interrupted for many hours yesterday, had it not been for the Mackay-Bennett cable *via* Coney Island." A similar condition of affairs existed between New York and Chicago, April 5. The Philadelphia *Evening Telegraph* of April 6, under the heading of a "Wide-spread Storm," says: "The only wire working between Chicago and New York this morning is the one carrying the Western Union stock quotations. At the Western Union, Mutual Union, United Lines and Baltimore & Ohio, messages for the East were not received, except 'subject to delay,' which meant delivery to-day, to-morrow, or next day. Not one of the private wires, for which something like $400,000 per annum is paid by the brokers, was working."

The Thomson-Houston Light in Omaha.

There has been considerable competition among the local electric light companies in Omaha, of which there were three until recently. The Sperry has retired from the field, its business being transferred to the Thomson-Houston Company. The Thomson-Houston Company at Omaha is under the management of Captain M. J. Fitz-Gerald, of the U. S. Army retired list. Mr. Revel R. Franc is the electrician. It started June 1, 1885, with one dynamo and hired power. The number of lights it furnished was 16. By Nov. 1 the company had erected works of its own. It had 2 Westinghouse engines, a boiler and 4 dynamos, and a capacity of 120 lights. Later on another engine and boiler and two dynamos of 60 lights were put in. The Sperry lamps are being replaced by those of the Thomson-Houston system, and the company is once more increasing its plant—this time to double its present capacity. The rate charged by the company is $10 a month for a 10-o'clock light, $13 a month for a 12-o'clock light and $20 for an all-night light.

Sending Sketches by Telegraph.

Our readers will already have become acquainted with the various forms of fac-simile telegraphs by which manuscripts and drawings can be reproduced at a distant station by means of the telegraph. Most of these fac-simile processes come under the head of chemical telegraphs, and are based upon the decomposition of a solution, usually of iodine, by the passage of a current. They all require special apparatus of a more or less complex nature, and hence are not adapted for every day rough-and-ready work. Recently, however, Lieutenant Glen and Lieutenant-Colonel Melville, of the English Army, have independently hit upon an ingenious system, by which the ordinary operation of telegraphing may be made to serve the purpose of reproducing sketches and plans. Strictly speaking, the system is not a fac-simile in the true sense of the word, but by its means very fair reproductions can be obtained, and its value in some situations and circumstances may be considerable. The method consists of either drawing the design to be transmitted on ruled paper, divided into little squares by vertical and horizontal lines, or laying a transparent paper, tracing cloth, or other transparent sheet, which must be so divided by lines into squares, over the drawing. The squares in each compartment, as shown in Fig. 1, are denoted, respectively, by pairs of letters, the alphabet running down the outer side for the horizontal rows of squares, and along the top for the squares in vertical series. A corresponding paper, which may be of a different scale if convenient, is kept at the receiving station. The operator at the transmitting station can thus indicate by alphabetical letters to the receiving station any point on the paper falling in the centre of any of the squares; the person at the receiving station will apply his pencil to that point, and will then be directed to the next point, drawing a line with the pencil, and so on to form a complete outline drawing.



FIGS. 1 AND 3.—SENDING SKETCHES BY TELEGRAPH.

Our illustration, Fig. 2, shows a fancy portrait; the one being the original, the other the transmitted copy.

Patches of shading, of the several darker or lighter tints shown in Fig. 3, may be put in by special directions, the transmitting signs for which must be preconcerted.

Paper ruled with squares of any size, large or small, may be used, according to the purpose and nature of the drawing, but in the "sectional paper," adopted by one of the inventors, the parallel ruled lines are set one-eighth of an inch apart, giving sixty-four little squares to one square inch. Where greater minuteness of delineation is required, there is a way of getting several exact points within each little square, as well as its central point; this is obtained by setting two additional letters, instead of one letter only, at the head of each vertical column of squares, and at the end of each horizontal row of squares, practically subdividing each square into four. The sender of a message, when the drawing is so large as to extend over a number of quadrangles, must apprise the recipient of it which is the particular quadrangle or division of the paper that he has in hand; but this is easily done by prefix signal-letters. The scale of the map or plan is also to be stated, which will suffice to the recipient for learning the measurement of all distances within the plan.

This system may evidently be made of considerable value in military operations in transmitting plans and maps, and may also be found of value in times of peace for various purposes, which will suggest themselves. Our limited space prevents us from entering more into the detail of this interesting application of the telegraph, and we may refer those who desire a more minute description to the April quarterly publication of the Journal of the Royal United Service Institution.

FIG. 2.—SENDING SKETCHES BY TELEGRAPH.

The Pan-Electric Investigation.

The Pan-Electric investigating committee resumed its labors on April 21 with the examination of Mr. D. Humphreys, of the Globe Telephone Company, of New York. That gentleman said that while the Memphis suit was pending he had concluded that it would be wise for his company to join in the Government suit if there was no objection, and he had gone to Washington and seen Gen. J. E. Johnston, Gen. Atkins, and Gen. Bradley T. Johnson. In September he called upon the Attorney-General, but Mr. Garland had cut him short off, and refused to hear him. "I told him," said the witness, "that I did not come to see Mr. Garland, but to see the Attorney-General; that he must not consider himself individually in this case, but as Attorney-General." He told me positively that he would have nothing to do with it. I told him he must have something to do with it; that I had no other recourse; but he still refused to say a word. I then asked him to whom I could go; to refer me to somebody; but he said he could not and would not refer me to anybody; that he was estopped from any action. I went there to get some expression of opinion, but I did not manage to do it. Finally, I presented my petition to Mr. Goode, and it was referred to the Interior Department. I was considerably worked up; I thought he should have more nerve. However, I went away feeling much more respect for Mr. Garland than I had before." Witness remarked that Mr. Garland entirely convinced him that he was incorruptible.

Assistant Patent Commissioner Vance was next examined, but had little that was new to communicate. Another witness examined last week was Representative Dunn, of Arkansas, who testified that Senator Garland and Mr. Young had both advised him to invest no money in Pan-Electric stock. Senator Garland had said the stock was like a lottery ticket and expressed the opinion that while all other patents might fall in a contest with the Bell patent on the question of infringement, yet the Pan-Electric patents might stand on one point, which he stated with distinctness, and he sustained his opinion with a citation of an authority.

Telegraphing Gladstone's Home Rule Speech.

The English Press Association says that a rough estimate made by the post-office authorities shows that the number of words signaled out of London on the occasion of Mr. Gladstone's Irish government statement was about 1,500,000, being almost twice as many as on any previous occasion, the highest hitherto being 860,000. The total number of words delivered at the various offices in the provinces was, however, very much larger, since many of

the reports were sent to a number of addresses. In the reports of the proceedings in Parliament sent by the Press Association, for instance, the total number of words delivered of the verbatim report of Mr. Gladstone's speech was 1,185,600, while of the summaries of the same speech 413,600 words were delivered, and of Mr. Parnell's speech 104,400. There were also 175,113 words of other parliamentary speeches, the total number of words delivered by the Press Association in its Parliamentary services being 2,029,113, or upwards of 1,000 columns of solid newspaper type. According to the post-office counting, Mr. Gladstone's speech, verbatim, extended to 24,700 words.

Electrical Lighting by Means of Low-Resistance Glow Lamps.*

BY ALEXANDER BERNSTEIN.

(*Concluded.*)

We now leave the central station, and turn our attention to the conductors. These are 20 pairs of copper wires of small size, say No. 6, well insulated. Experience has shown, so far, that there seems to be no great difficulty in insulating a wire if the tension of the current is not more than 2,000 volts. If we suppose that the central station is in Pimlico, on the banks of the Thames, a few wires may be laid in the direction of Victoria Station, a few more may reach the Houses of Parliament, some may be laid in the direction of South Kensington Museum, and some others may be used for lighting private houses—in each of which I shall suppose that, upon an average, 20 lights are used at the same time. In this case 15 houses are passed by the same conductor, which supplies current for 300 lamps. All these currents can be turned on or off at will, quite independent of each other, because we have provided in the central station that each dynamo is regulated in such a way as always to produce the same strength of current, no matter whether there are 300 lamps alight in each conductor, or only 10.

Let us now compare this system with the only other system in which glow lamps are arranged quite independent of each other, leaving out the consideration of secondary generators. In the parallel system the central station must be in the centre of the district to be lighted, which is often very objectionable, and sometimes impossible. In the series system the station may be far out of the way. In the parallel system we are restricted to the use of a 100-volt lamp, as we have seen before, and, in consequence, the radius of the district to be lighted must be kept very small, or the expenditure for conductors would be prohibitive. In the series system the expense for conductors is comparatively small, and we may reach any distance. The parallel system requires that a fixed difference of potential should be maintained in all the conductors under varying strength of current—a condition with which it is even theoretically impossible to comply, and which entails enormous practical difficulties. In the series system we have to maintain a constant current under varying resistances—a condition which can be easily fulfilled. When the parallel system was first developed, the prevailing idea appears to have been to make electric lighting from central stations similar to gas lighting. But the conditions under which electrical energy in its active form is best transmitted are so different from those requisite for the transmission of the potential energy of gas that the desire to imitate the gas system has proved rather a disadvantage.

We now arrive at the last, and perhaps the most difficult, part of the whole installation, viz., the outfit of the place which is to be provided with lamps. For the sake of simplicity, I will suppose the place to consist of one single room, as shown in the sketch, Fig. 3. In this sketch the small circles O, marked *L*, represent lamps; the squares □, marked *S*, represent switches (which will be presently described); and the cross +, marked *V*, is to indicate a registering voltmeter. The street main, *M*, enters the house at the main switch, drawn larger than the others; it continues from switch to switch, and returns to the main switch before leaving the house. We have supposed the street mains to be composed of No. 6 copper wire, but the house mains may be made equal in section to No. 10 wire, in order to be more flexible. The lamps are always connected to their respective switches.

From what has been said before, it is quite evident that the first and essential condition of such a system must be that the circuit is never to be opened, whatever may happen. As we are always dealing with a closed circuit, it will prevent misunderstanding if we give a different designation to the two ways in which the circuit can be completed; and I shall therefore call the circuit "short-closed" if the current goes directly through the switch-lever, and "long-closed" if the current is led through the lamps or other electric devices, such as motors, which are to be acted upon. The fact that the circuit is never to be opened reduces one great difficulty in the switch required in the paralled system, viz., the liability to produce an arc.

The main house switch, to which I shall now invite your attention, serves the purpose of either short-closing the street circuit, so that no current can pass into the house, or of long-closing the same, thus including the house circuit into the main circuit. In the first case I have not considered it sufficient merely to prevent the current from entering into the house; I have thought it advisable to disconnect the house circuit entirely from the street circuit at the same operation, so that any alteration of the circuit may be made inside the house without the possibility of a branch current being established, even if the street circuit should be of defective insulation. But this switch is also made to answer another purpose. Supposing that the street circuit, which has been short-closed, is now to be long-closed, but that by some accident or another a break of the continuity of the line has occurred in the mean time inside the house; if now the switch-lever were to be moved with the intention of allowing the current to enter the house, the result would be the formation of a long arc, and eventually the whole current would be interrupted. The manner in which this has been rendered impossible can be best explained by reference to the annexed sketch, Fig. 4, in which *A* is the switch-box, made of insulating material, and *L* the switch-lever, made of conducting material. *C*, *D* and *E* are three pieces of metal let into the upper edge of the circular box. The lever *L* may occupy three positions, marked 1, 2 and 3. In position 1, *C* is connected with *E*, and as *C* is one terminal of the main

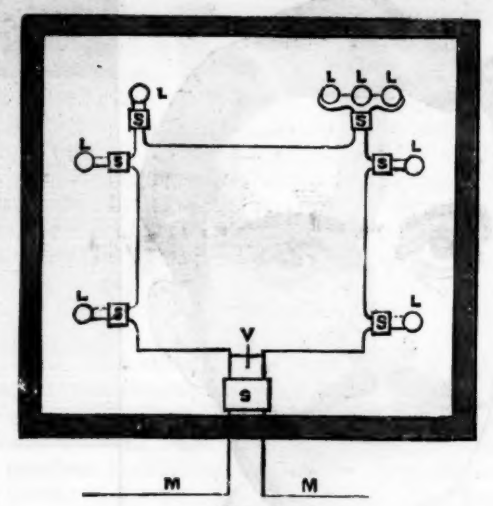


FIG. 3.

circuit and *E* the other, this circuit is now short-closed. But if the lever *L* is in position 1, it lifts two flat springs of metal, *F* and *G*, which are the terminals of the house circuit, from their respective seats on the metal pieces *C* and *E*. The lever *L* carries on its upper side two pieces of insulating material, on which the two springs *F* and *G* now come to rest, and consequently the house circuit is out of all electrical connection with the main circuit.

If it were now intended to allow the current to pass into the house circuit, the lever *L* would have to be turned from position 1 to position 3; but when the lever passes over the intermediate position 2, it first connects the metal piece *D* with *E*. But the metal piece *D* is permanently connected with *C* by means of the resistance *R*, and the main current will therefore be divided in two parts—one, the greater portion, passing through *R* and *L* to *E*; the other, the smaller portion, passing through the house circuit in case the same is complete. This house circuit includes the electro-magnet *K*, which is situated inside the switch, and the armature of this electro-magnet carries a pin *P*, which is in such a position that it is below the plane of the motion of the lever *L* if the armature be attracted, but hinders this motion if the armature be not attracted. In case, then, that the house circuit is complete, there will be no impediment to the further motion of the lever *L* from position 2. It will therefore reach position 3, where it rests upon pieces of insulating material, and the whole current now passes through the house circuit. But if the house circuit had not been completed, the motion of the lever would have been arrested by means of the pin *P*, and a break in the circuit is in this way made a matter of impossibility.

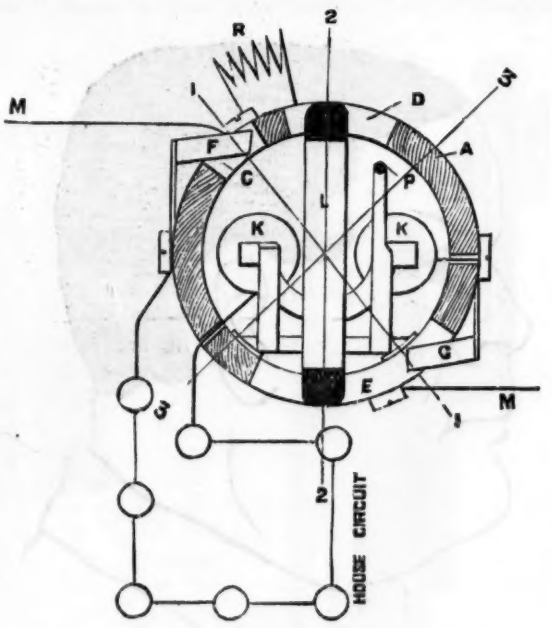


FIG. 4.

I shall pass at once to the lamp switch, because it is practically a mere repetition of the main switch on a smaller scale. But the lamp switch contains an additional arrangement, which would be a useful adjunct to the main switch as well, viz., the automatic cut-out. This is intended to act if the lamp should fail during the passage of the current, in which case the break of the circuit is prevented by short-closing it around the lamp. The arrangements which I have used to provide for this eventuality are of two kinds, and may be shortly described without reference to any drawing. Both are based on the principle that if the resistance of the lamp increases—which always occurs in lamps placed in series when the carbon gives out and an arc is formed—then a current in a shunt around the lamp will increase. In one of these arrangements this increased current is made to act upon the armature of an electro-magnet, which armature releases a spring for the purpose of making a direct secure contact between two places of the circuit in which the lamp is situated, and a short-circuit is thereby formed round the lamp. In the other arrangement a fusible wire is placed in the shunt, and a lever is arranged in such a way as to be acted upon in one direction by the wire, and in the other by a strong spring. If the wire fuses, the spring presses the lever against contact pieces, which serve the same purpose as specified above. In neither case can the circuit, which is now short-closed, be made to include the lamp again until the cut-out lever has been moved into its former position by hand. The combination between the switch and the cut-out lever is such that the switch-lever has to be placed into position 1 before the cut-out lever can be operated upon by hand. The reason for the adoption of this last arrangement will become evident by a consideration of the peculiarities of the switch which I have mentioned before. I believe that in this way I have provided for the prevention of a break in the circuit which may occur from any eventuality.

I need not dwell on the construction of the lamp-holder, the only part of the outfit which has not yet been mentioned. It may be made in different ways, but one principal idea has been adhered to in its design, as well as in that of all other details which constitute the outfit of a house; there is no part conveying a current which is not perfectly insulated, or which is in any way exposed so as to offer the possibility of any person coming into contact with it. This is hardly possible in arc light circuits, but may easily be done where only glow lamps are used.

And this brings me to the last question which I shall have to consider, viz., the question of safety. Here again I shall have to note one very great advantage of the series system over the parallel system, and this is the impossibility of a wire becoming overheated. Every experienced electrician knows as a fact that short-circuits in the parallel system have often led to detrimental results in spite of safety fuses; and a system in which such a danger does not exist, and which consequently does not require any provisions against it, has certainly much to recommend it. Especially in such cases in which the danger of fire must be most dreaded—in ship lighting—I believe that this advantage of the series system will be very greatly appreciated.

I now come to the objection generally raised against the use of high-tension currents. If an inventor were to appear to-day, saying he wanted to introduce into our houses a substance which, when properly used, was intended to give light, but which in itself was a poison, and produced poisons when used as a light, and of which it was further known that it was always ready to form an explosive agent when mixed with atmospheric air, I believe that the critical spirit of our time would raise an outcry against the introduction of such a dangerous substance, and against the use of the public streets for its conveyance. But this substance—of which we know that it is quite harmless as long as it is retained within metal tubes—is now actually carried into all our houses, and we are so familiar with its peculiarities that no one feels any nervousness nowadays in the neighborhood of a gas chandelier.

In conveying a high-tension current into a house we are in a far more favorable position than if dealing with gas, because the probability of an accident is far more remote. Three conditions must be fulfilled before any person can be injured by an electric current. First, there must be a certain amount of leakage on the line; secondly, the person must be in contact with a bare conductor; and, thirdly, the person must at the same time be in contact with the ground.

In the system of central lighting which I have laid before you, it is easy enough to constantly ascertain the condition of the line, and far easier to locate a fault than in a complicated system of branch wires. It is, further, easy to construct all parts of the system inside a house in such a manner that contact with a bare conductor is impossible; and, moreover, a person standing on a carpet and a dry wooden floor is exceedingly well insulated. The tension which we can use with safety depends simply upon our means of insulation. If you will recall the precautions which have been taken in the construction of the switches by entirely disconnecting parts of the circuit from the main circuit, when lamps have to be replaced or alterations to be made in the circuit, then I think you will agree with me that the probability of an accident is exceedingly remote; and this system of lighting appears to offer more

* Read before the Society of Telegraph Engineers and Electricians March 25, 1886.

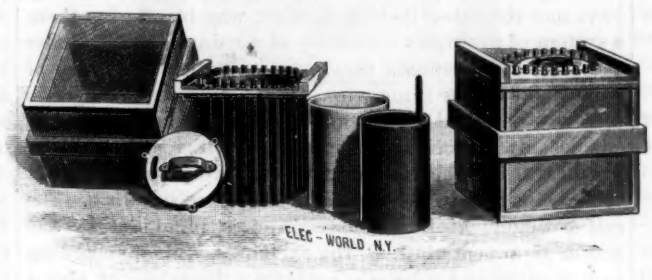
safety than any other method of artificial lighting at present in use.

And now, in conclusion, I should like to say that in a short paper like this which I have had the honor of reading to you, I found it impossible to enter more fully into details than I have done, and I have therefore restricted myself to the explanation of those details and the discussion of those questions which appear to me of prominent importance. I hope that by my humble efforts I may have accomplished the object of my labors, namely, the further extension of the field of electric lighting.

An Improved Cell for Domestic Electric Lighting.

The attention and care required in handling galvanic batteries has always been one of the drawbacks to their introduction in private installations as a source of electricity for the production of light and for small power, and hence some improved form of battery for domestic purposes has been in demand to obviate much of the existing inconvenience and mistrust. Acting upon this idea, the Chemical Electric Light and Power Company, of Boston, which employs what is known as the "Volta Pavia" solution as a depolarizer in its battery, has devised a form of cell which we illustrate in the accompanying engraving, the constituent parts being shown separately.

To avoid breakage of glass jars, the cell is made of wood, nicely fitted together, and covered with asphaltum paint. It is then lined throughout with lead plates, weighing 2½ pounds to the foot, and these plates are welded together at all joints, forming a solid leaden jar, which resists the action of the solution and cannot break or crack, and with fair usage will last indefinitely. Inside of this jar stands the large, specially devised porous cup, made of a peculiar clay having the proper porosity to separate the outer and inner fluids without offering much internal resistance, and having a groove in the bottom to receive and hold in position the zinc and also to hold a small quantity of mercury, which keeps the zincs properly amalgamated. Inside the porous cup stands a rolled zinc cylinder weighing 8 pounds, presenting a large surface for action. The zinc remains in the solution at all times; but there is no local action when the circuit is broken and work is stopped, as is the case when lamps are turned out or motors are disconnected. These zincs, it is claimed, will last from 600 to 800 hours of actual work, *i. e.*, will give five hours of constant work per day for 150 to 160 days, and with ordinary usage two of them will last a year. The cover to the cell is one of its most important features, as it serves to close the jar and forms the carbon electrode or pole. This cover is made of wood, with rebated edges, fitting nicely the upper edge of the leaden box. Thirty ½-inch carbon pencils are inserted in holes which describe a circle around the porous cup in such a way that the pencils present a continuous surface to the zinc just outside of the porous cup, allowing the solution in the outer jar to diffuse itself between the pencils. These carbons are all connected together on the top of the cover and brought to one terminal, so that when the cover is in place only two poles are presented. The zinc terminal projects through the circular cover, which can be removed when it is necessary to renew the porous cup fluid.



THE "VOLTA PAVIA" CELL.

Arrangement of Vats for Electrolysis.

BY H. B. SLATER.

In that department of electrical science which relates to electrolysis, or the electro-deposition of metals, most writers on the subject, whether in text-books or periodicals, have contented themselves apparently with an exposition of their own knowledge of the subject for the benefit of such as understand it as well as or better than themselves, as if writing a thesis, which, if successful, should entitle them to a higher degree of consideration, as men of science, instead of a set of simple, practical instructions, which would gain for them the thanks of a great many persons less favored.

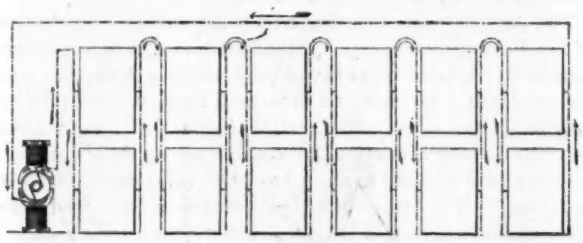
It is safe to say that among the thousands who are engaged in the electro-deposition of metals, whether on a large or small scale, in this country, there are very few indeed who have even a rudimentary knowledge of the "laws of electrolysis," the "laws of the current" or the true meaning of electromotive force, resistance or current. Most of them will talk glibly enough of *quantity* and *intensity*, without disclosing a spark of knowledge of either. They will talk just as freely of "series" and "multiple arc," and yet nine out of every ten would be unable to tell the advantages of either the one or the other arrangement, and in many cases could not explain the difference between the two. We have all heard of him who, when carrying his grist to the mill, slung the sack over his shoulder with the grist in one end of the sack and a stone in the other end to balance it. That was a long time ago, and one would hardly expect to see the like in these days, but I saw it being done not long ago by an *electrician*. Having been called in to advise with a gentleman engaged in the electro-deposition of copper, I noticed that there were two vats connected in "series." In the vat nearest the dynamo the work was placed, consisting of surfaces destined to receive a coat of copper. In the second vat of the "series" were three plates of copper, two of which occupied the position of anodes, and the third that of a cathode, the three plates simply affording a passage for the current and offering a very great resistance as compared with that of the work in the first vat. On asking the *electrician* the reason for such an arrangement, his answer was: "To take the load off the machine."

I will say here that I was called in to explain why so small an amount of copper was being obtained for the time and power expended. The dynamo employed was capable of depositing a full 10 pounds per hour, but they were only able to get from 4 to 6 pounds per day. It is for the benefit of such as have been unable to grasp the ideas of writers who have published books on electricity, and who have, in some cases, been more than liberal in the treatment of electrolysis, that the following description of a working plant for the deposition of copper has been written. In giving the dimensions, I have preferred to use the metric system as being easier for calculation, but will suggest to such as may not have a knowledge of it that 10 centimetres equals 4 inches approximately, and that therefore 1 inch will equal 2.5 centimetres very nearly, at least near enough for comparison. The technical electrical terms need not frighten the uninitiated, as he has only to bear in mind for the present that the quantity of current passing in a given time is the measure of the quantity of metal deposited in that time. In other words, 1 ampère of current will in one hour deposit 1.1925 grammes = 18 grains of copper.

The plant I have in mind is that of the Dupont Metallic Art Company, of Detroit, Mich., and is being worked in the production of decorative art work in metal, such as plaques, bas-reliefs, portraits, mural decorations, etc., etc.

The depositing room is arranged as shown in the accompanying diagram.

The vats, as will be seen, are connected in a "series" of six pairs, each pair being in "multiple." The reason for this arrangement in "multiple" and "series" will appear if we consider the whole system of vats as we would a metallic circuit. If we have a metallic circuit of a given cross section and a given length, we shall have a certain resistance; now if we increase the length we shall increase the resistance, while if we increase the cross section we shall decrease the resistance. We can, therefore, increase the length of our circuit indefinitely provided we make suitable increase in the cross section. There is a limit, however, viz., that of cost, to the increase of a metallic circuit, and in electrolysis we are limited by the required density of the current.



ARRANGEMENT OF VATS IN SERIES FOR ELECTROLYSIS.

In this installation the metallic conductors are sufficiently large to allow us to ignore their resistance; nevertheless, an allowance is made in the calculation of the total resistance.

Length of each vat = 1.365 metre.

Depth of each vat = .905 metre.

Width of each vat = .750 metre.

Useful depth of each vat = .820 metre.

By useful depth is meant the actual depth of solution contained.

The useful capacity, therefore, = 1.365 × .750 × .820 = 839,475 c.c. = 849.475 litres.

Dimensions of anodes, 61 cm. × 61 cm. = 3,721 sq. centimetres. Anodes in each vat = 5, each having two sides = 10 × 3,721 sq. cm. = 3.721 sq. metres.

The solution used consists of sulphate of copper, 153.35 kilogrammes = 337.37 lbs.

Sulphuric acid, 66°, 34.306 kilogrammes = 75.64 lbs.

Water, 686,120 c.c. = 150.944 gals., or 686,120 litres.

This solution has a specific resistance of 32 ohms at 20 degrees centigrade. That is, a cubic centimetre of the solution has a resistance of 32 ohms, considered between any two opposite sides of the cube. Now if we bear in mind what has been said as to increasing or diminishing the resistance of a circuit by increasing the length in the one case, or the cross-section in the other, what follows will be easily understood. The resistance of each vat is found by dividing the specific resistance (32 ohms) by the number of square centimetres in one square metre (10,000); then multiplying the result by the distance apart of the plates, in this case 10 centimetres, and dividing that result by the total anode surface in metres, as follows:

$$\frac{.0032 \times 10}{3.721} = .0085998 \text{ ohm.}$$

But the cross-section of the circuit has been doubled by coupling two vats in multiple, and so the resistance has been divided by two = .0042999 = the resistance of each pair, and for the six pair .0257994. Now we have in addition a resistance in the form of an opposing electromotive force equal to about .016 ohms per vat, which, multiplied by the number of vats, gives 12 × .016 = .192, which added to .0257994 = .2177994. To this we will add 10 per cent. as an estimated resistance of conductors and connections, and we have as a total resistance .2396 ohms for the entire installation of 12 vats.

Since these vats were set up three more have been added to the series, one containing 200 gallons of brass solution one containing 150 gallons of nickel, and one with 80 gallons of silver; the three being so arranged as to resistance that they equal a pair of the copper vats, and so do not interfere in any way with the working of the twelve. It will be seen that with a dynamo giving 5 volts a very large addition can be made to the present series.

There is about 30 square feet of surface in each vat, and a current of 600 ampères, therefore, gives a density of current of 20 ampères. This density gives excellent copper; soft, smooth and capable of being bent double and hammered without fracture.

The full capacity of the present plant is about 150 pounds of copper per ten hours.

When the deposit on each mold has reached sufficient thickness it is removed and the mold replaced. The copy is then finished in some one of the various styles known to the art, a full line of apparatus for which is to be found in the works of this company. The pieces turned out are worthy of a high place among objets d'art of their class, and the shell is such as to please the most exacting electroplater.

The Denver Telephone Exchange.

The central office system in operation in Denver differs considerably from that in other telephone exchanges. It is quite ingenious, and by its use subscribers get exceedingly prompt service, while it enables the managers to keep accurate and complete statistics of the amount of business transacted each day. The system, which in a slightly modified form is also in operation at Omaha, has proved itself very satisfactory indeed, but it can only be used by exchanges of from 500 to 800 subscribers.

The system used is what might be termed an improved Gilliland system, as the company uses the Gilliland switch-board, but has added to it a great many ingenious devices; and uses the switch-board itself, which is not of the desk form, in a method different from that generally adopted with such boards. The board is arranged in 100 subscriber sections; a switch operator attends each section, and behind these sit two receiving operators at small tables who each receive the calls from nearly four hundred subscribers. The switch operators have no telephones and their only work is to listen to the receiving operators and plug any subscribers called in their sections to connecting strips designated by the receiving operators as the calls are given. The subscribers are provided with magneto bells. To call, they ring and throw annunciators in the central office; the shutters of these annunciators fall upon a metal strip which is connected with the receiving operator's telephone, thus automatically connecting calling subscribers with the listening operator. The receiving operators are provided with sheets of paper upon which to record the calls; these sheets are ruled and spaced to correspond with the connecting strips of the switch-board assigned for their use.

The connecting strips all end at a "disconnecting" table, at which are seated two operators who each attend to the connections called by one receiver. At this table each connecting strip is provided with an ingeniously designed switch for rapidly connecting either generator, clearing-out drop, operator's telephone or an automatic disconnection signal, as the state of the connection on that connecting strip may require. Subscriber No. 150 wishes to call subscriber No. 676. He rings up central office, and immediately removes his telephone from its hook and gives his call to the receiving operator, who instantly repeats it aloud to the switch operators, at the same time writing the numbers 150 and 676 in the space on her paper corresponding with the connecting strip upon which she has called the connection. From the time the subscriber first rings to the time the connection is made on the switch-board and the called subscriber's bell is ringing, is generally four seconds.

Immediately behind the receiving tables there is a "busy" table, at which sits an operator whose duty is to complete connections when the called subscriber is at first talking with some one else.

As will be noticed, the work is so classified that each operator has only a particular part of each connection to attend to, and she necessarily becomes very quick and expert in her part. The subscriber in consequence gets very much quicker service than is generally given by exchanges of this size when operators are required to take calls and make the corresponding connections and disconnections

themselves. There are only about thirty circuit lines entering the central office; these are attended to by a separate operator, who also attends to the giving of information of all kinds to inquiring subscribers.

The office is an unusually quiet one. There is no talking or noise of any kind heard except the repeating of calls to the switch-board operators by the receiving operators, and they talk in an ordinary tone of voice. No checks or electro-magnet signals from one operator to another are used.

The following figures are of interest and of particular value because they are taken from the actual daily records of calls which are made every day.

Sundays and holidays are not included in the averages.

STATEMENT FOR THE YEAR ENDING DEC. 31, 1885.

Total No. of subscribers Dec. 31, 1885	768
Population by Denver census, 1885	55,000
Total No. of calls by subscribers during year	1,411,692
Average No. of calls per day	4,583
Average No. of calls per day per subscriber	5.78
Greatest No. of calls in one day (July 3)	5,569
No. of local operators, day and night	16
Greatest No. of calls taken in one day by one receiver (March 29, 1886)	2,363
Greatest No. of calls taken in four hours (from 8 A. M. to 12 M., Jan. 1, 1886)	1,368

The exchange now has 815 subscribers, and the calls average 5,000 a day. Mr. W. S. Ford, a promising electrician, is manager of the operating department, and Mr. T. S. Gamewell is foreman of construction, while Mr. E. B. Field is general manager. The company has nine other exchanges in Colorado. The longest ex-territorial line is to Pueblo, 114 miles. It is of No. 9 iron wire. Four ex-territorial lines also run to Colorado Springs, 60 miles in one direction, and to Georgetown, 60 miles in another direction. In addition to Colorado, the company also controls the telephone business in New Mexico, where it has two exchanges. It has about 70 miles of pole lines and 470 miles of wire in Denver; about 400 miles of pole lines and perhaps 600 miles of wire in Colorado, outside of Denver, and 30 miles of poles and 100 miles of wire in New Mexico. Both in Colorado and in New Mexico the company finds its business and profits steadily growing.

Electrical Matters in England.

An English correspondent sends us the subjoined notes relative to electrical matters in England at the present time:

Referring to some experiments on the magnetic properties of iron (which are not yet published), Dr. John Hopkinson, F. R. S., remarked lately in a discussion on dynamo machines, that many of the results obtained were of practical interest in connection with dynamos. Besides dealing with the magnetic properties of iron, he had made a considerable number of experiments upon the electric conductivity of various samples, for the purpose, primarily, of ascertaining whether there was any connection between the magnetic properties and the conductivity. It resulted in nothing in that direction; but one interesting result came out, that the electric resistance of the samples of cast-iron which he had tried was ten times as great as the electrical resistance of pure iron. That result had certain important applications to dynamo machines. Dr. Hopkinson also alluded to certain results obtained from a large number of samples showing their magnetic property, rendering it possible to determine the magnetic movement of certain simple shapes without further experiment. Another interesting feature he had occasion to remark was the extraordinary effect which the presence of manganese in steel had upon its magnetic properties. The presence of about 12 per cent. of manganese had the effect of making steel sensibly non-magnetic. The small amount of magnetism which remained would be fully accounted for by supposing, that mixed up with non-magnetic alloy of manganese and iron, there was a small quantity of free iron. Facts of this kind, Dr. Hopkinson felt assured, must ultimately have a very considerable bearing on any scientific theory which might be propounded as to the nature of the magnetization of iron.

It is a very fortunate circumstance that fires in telegraph offices are but of rare occurrence, as they would be productive of great inconvenience to the public. Hitherto none have occurred in telephonic exchanges here, but as the exchange is only a very recent institution, there was hardly time for such an occurrence. But it has come and much inconvenience has been the result. You may imagine the consternation in a very busy place like Liverpool, when 1,200 subscribers found that a serious fire, early one morning in the central exchange had completely destroyed all telephonic communication throughout the city. The fire was discovered about 1 A. M. on Wednesday the 7th, and it appears to have originated in the test room, which it destroyed, thence raging upward, and making "a general average" of the switch room. It was some hours before the fire was finally extinguished, and then the damage was apparent. Almost complete renewal was necessary, especially with the wiring. No time was lost, for while the place was being cleared, new material was requisitioned and arrangements were made for the work to be gone on with night and day. Fortunately, the necessary material was found available, more than twenty miles of insulated wire being required, and after great exertions, the exchange was again open for business on Monday morning, the 12th inst., or only five days after the fire. There was one point deserving of notice in this fire, and that is regarding some new telephone (100-wire) cables fixed but a few days before the fire.

In ordering the last cables for the Liverpool Exchange, it was particularly specified that the cables were to be "non-inflammable." Messrs. W. T. Glover & Co., of Manchester, who are well-known manufacturers of all kinds of wire, supplied the company with some lengths of their patent "non-ignitable" telephone cable. From information to hand, this form of cable was subjected during the fire to the severe effects of flame and heat, and while every other form of wire was destroyed, these cables came out of the early and unexpected test in a remarkably satisfactory manner.

This same company, the Lancashire & Cheshire Telephonic Exchange Company, is decidedly enterprising. It has gone well in for the inter-town telephonic exchanges and also for the "call" system. Its exchanges are in all the principal towns of Lancashire and Cheshire, and all these are connected together, and yet the subscribers are not satisfied. One would fancy that they still want *more*, but they want *less*; that is, they want to pay less for the same service. The directors, however, do not see it in the same light, as they have heavy royalties to pay, but they have met the subscribers in another way by offering them a system of multiplex telephony at a reduced rate. Under the new arrangement they propose to put a number of subscribers on the same wire. The service will be done by a new patented arrangement, which is automatic. It enables any subscriber to speak to any other without being overheard, for the system cuts out every telephone but those belonging to the two parties who are speaking. The call arrangement is automatic, and is regulated by the action of a pendulum at the exchange, which, according as it is adjusted for length, actuates a pendulum of also a certain length at the subscriber's, and calls attention by ringing the bell. When the subscribers are switched together, the exchange cuts out all the rest, which are restored to their normal condition when the subscribers ring "off." This new service will be offered at a reduced rate and it is believed it will answer financially to both sides. The plan has been tried and is working, and arrangements are being made for its adoption wherever required by the subscribers.

Your readers will doubtless be pleased to hear that numerous successful trials have been made by the Post Office with Mr. Delany's excellent multiplex system, which was not long ago illustrated in your columns. Since that notice further improvements have been made, and it is now about to be specially used between London and Manchester. The previous trials, which were all successful, were first of all between London and Brighton, then between London and Bristol (more than double the distance), then again between Central Station, London, and Manchester, or nearly four times the distance of Brighton. It was also tried for some time between London and Newcastle, and it is finally decided to place an instrument in Manchester and one in London entirely under the control of our own Postal Telegraph operators. The result will be looked forward to with much interest.

The three electric lighting bills were before the House of Lords on Monday night (12th April), and a select committee was appointed to investigate them. A motion was adopted that "all petitions presented against these bills be referred to the committee, and that the petitioners have leave to be heard before the committee by their counsel, agents and witnesses in support of the allegations of their petitions." The first committee meeting is the first day after the Easter recess.

The government bill, introduced by Lord Houghton extends the time of compulsory purchase from 21 to 30 years, and with the consent of the Corporation to 42 years, the terms of purchase as at present to be the then value, only, of the undertaking. The government bill is considered a recognition of the contention of the electric lighting companies that the term of 21 years did not allow them sufficient time to recoup their outlay, and that the financial disadvantage under which they were thus placed was the reason why electric lighting had not grown as it otherwise should have done.

Some time since a Royal Commission was appointed to inquire into the cause of "accidents in mines." The inquiry naturally was very extended, and embraced among other points the best form of safety lamps for use in mines. Numerous lamps were forwarded to the commissioners in reply to their invitation, and descriptions of several of these lamps (incandescent) have appeared in our journals. Now that these exhibited lamps have passed from the hands of the commissioners, it is considered undesirable that the collection should be scattered without the public, and especially those particularly interested in the subject, having an opportunity of seeing and examining them. It has, therefore, you will be glad to hear, been decided that they shall be removed to the School of Mines, in London, and there remain on exhibition. Thus, full opportunity will be given for all the necessary information to be obtained on so interesting a subject. These lamps, as they were received, were forwarded to Woolwich Arsenal, where, by permission of the authorities, they were examined and tested by Sir F. Abel, F. R. S., and Mr. Burt, two members of the commission. The final report of the Royal Commission—a bulky Blue-Book of about 300 pages—has just been issued, and contains naturally a mass of valuable and interesting matter. On the electrical question, the commissioners in their introductory remarks observe: "Much attention has been given by your commissioners to the question whether electricity can be safely and advantageously applied to underground illumination, not only at the pit bottom and in adjacent roadways, but also as a substitute generally for the safety lamp, and as an auxiliary illuminating agent in mine workings, etc. We have examined into the results furnished by experimental installations which have been established at some collieries, and have investigated the efforts made from time to time to produce self-contained electric lamps in a form available for the use of the mines." The results of these inquiries, the commissioners are glad to say, are in several respects of a promising nature. It is interesting to draw attention to the conclusions the commissioners have arrived at with respect to the utilization of the electric lamp. The convenience and efficiency of glow-lamps have been demonstrated by actual experience. It is essential to safety as well as to the permanent efficiency of the installation that the cables should be placed in positions where they are thoroughly protected against possible injury. Glow-lamps should be excluded from direct contact with the air where fire-damp is known to exist. The illuminating power of these glow-lamps is continuously superior to that of ordinary lamps. "These lamps are perfectly safe, but as they do not afford any indication of the condition of the atmosphere in a mine, their employment, even if special fire-damp detectors are used, cannot in any case entirely dispense with the necessity for the use of some safety lamps. For exploring purposes after accidents, or in foul places, these lamps must prove very valuable even in the present condition of their development, and as auxiliary lights they cannot fail to prove very useful. The great progress which has recently been made in the construction of portable electric lamps affords promise of a speedy utilization of such lamps to an important extent in coal mines." Some twenty years since a glow-lamp was used in France with very great success in exploring in some mines after accidents had happened and where the air was so foul that no other lamp could possibly be used. It was the means of saving many lives. The lamp was the invention of a young Frenchman of the name of Dumas, and was manufactured by Breguet with the greatest care, so that it was perfectly sealed and no foul air was admitted. A small but powerful battery was used to act on a strong induction coil, which illuminated a Geissler tube of fluorescent glass of peculiar construction. The box containing the whole apparatus could be easily carried on the back, and the wires extending to the tube carefully protected in a strong crystal glass tube were sufficiently long to be held well in front. The whole was excellently manufactured and the light emitted was remarkably good. The durability of the light was over twelve hours of constant working. This was, it is believed, the first actual safety lamp lighted by electricity.

The Silvey Induction Telegraph.

To the Editor of The Electrical World:

SIR: Knowing Mr. W. L. Silvey quite well, I read with interest your paragraph in a late number of THE ELECTRICAL WORLD, describing his invention of the induction telegraph. It has been supposed that Mr. Edison had a patent on this device, inasmuch as he had recently made successful experiments in telegraphing from moving trains. I believe it is a fact that Mr. Edison has no patent on the induction telegraph, and the patent of Mr. Smith, of Kansas City, of which we have heard something in the newspapers, is on an induction telephone, and not a telegraph. It will, I think, be found that Mr. Silvey's patent is the only one that covers the induction telegraph proper. He thinks it will soon be adapted to purposes of far greater importance to the commercial world than the telegraphing from moving trains, although he recognizes this as a great achievement in both a commercial and scientific point of view. Mr. Silvey is an industrious worker, and has other inventions well under way that will be important steps in the march of electric progress.

CINCINNATI, O. R. C.

Induction Coil for Multiple-Contact Telephone Transmitter.

To the Editor of The Electrical World:

SIR: In your issue of March 27, I noticed a query from Dorchester, Mass. It seeks information regarding the best size for an induction coil to be used with a telephone transmitter with multiple contacts, using six cells of Leclanché battery. Having had a rather extended experience in this direction, I trust that the information which I offer will serve to help your correspondent out of his dilemma.

A long series of experiments has enabled me to determine the most effective proportions for a coil to be used with such a transmitter, and it will likewise be found to answer admirably in connection with almost any form of battery telephone.

They are as follows: Length of coil, inside measurement from head to head, eight centimetres (about three inches). The core is composed of a bundle of No. 20 or 22

iron wires. They should be well straightened, in order that as many as possible may be put into a given space. Having cut a sufficient number to form a compact bundle ¼ inch in diameter, scatter them loosely in a flat dish containing enough vinegar or dilute acetic acid to cover them. Allow them to remain until oxidized, or remove them and expose to the atmosphere till they become so. Rusty wires are preferable, and the foregoing process applies only to those which are new or unoxidized.

Thus prepared they should be bound firmly together with thin twine. Then, having put on the heads, which should be of varnished wood or hard rubber, wrap the core with two or three turns of writing paper. Wind upon this five layers of No. 18 (A. W. G.) cotton or silk-covered copper wire. This is the primary coil, to be covered also with several turns of paper. The secondary coil is now wound upon the whole, and consists of No. 32 cotton or silk-covered wire. The latter is preferable, and should be wound in not less than fifteen nor more than twenty layers, and without the interposition of any paper between them. Only see that the wire is well insulated. The primary or inner coil and the battery and transmitter are connected in series. The outer or secondary coil is placed in circuit with the line wire, which includes the receiving telephones.

SAN FRANCISCO, Cal. WM. A. J. KOHRN.

Engines for Jenney Plants.

To the Editor of The Electrical World:

SIR: In your recent mention of the Jenney light in California, there occurs an error, in stating that the Buckeye engine is largely, if not altogether, used in connection with Jenney plants.

We have purchased and are using Payne, Armington & Sims, Ide, Buckeye and Ball engines—one each of the last three in our factory. We have no special affiliation for either, like them all, and are trying to get at the peculiar merits of each. BRAINARD RORISON,

Secretary Jenney Electric Company.

INDIANAPOLIS, April 20.

Conductivity of Mixtures of Organic Compounds.

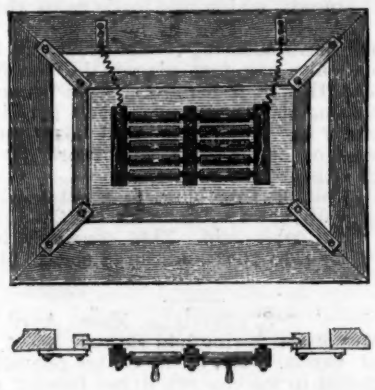
M. Bartoli has noticed, says the *Journal* of the Chemical Society, that although generally the electric conductivity of carbon compounds diminishes almost to zero at or about their points of solidification, yet certain mixtures and solutions of these compounds show an increase of conductivity at temperatures below that of the solidifying point, and a subsequent decrease to zero at a lower temperature. This phenomenon is not noticeable in mixtures of natural origin, such as the oils, wax, balsams and resins, but only in artificially prepared mixtures and solutions, such as napthaline with one of its derivatives, naphthaline or paraffine with phenol, phthalic or benzoic anhydride, and the acids of the acetic series. In this paper tables are given illustrating this phenomenon. As regards its explanation, there are two possible cases to be considered—first, that of a mechanical mixture, such as paraffine in annyl alcohol (or acetic acid); second, that of the mutual solution of the two components, such as naphthaline in one of its derivatives. In the former case the interdiffused liquid would have a constant conductivity independent of the temperature up to the point of its own solidification. A simple case of the latter is the solution of a small quantity of a conductor in an insulator; such a material shows two points of solidification, the one near to that of the more abundant constituent, the other immediately below. Between these two points there is a sufficient amount of conducting liquid interposed between the solid particles to admit of the passage of the current; but this gradually diminishes with decrease of temperature. This explanation is not, however, valid for compounds such as phenol and benzamide, which possess a certain amount of conductivity at temperatures far below that of their solidification.

Electro-Magnetic Action on Polarized and Natural Light.

Wiedemann's Annalen, No. 2, contains some interesting communications on this subject, which are commented on by *Nature*, as follows: In regard to the electro-magnetic rotation of light, Herr Kundt notes the fact that all simple substances hitherto examined, be they strongly magnetic or strongly diamagnetic, show positive electro-magnetic rotation. Negative rotation is shown only by chemical compounds, and such as contain certain atoms of strongly magnetic elements (as iron salts). Positive rotation has been proved in the case of eleven elements, viz.: Fe, Co, Ni, Br, Se, S, P, C (diamond), O, N, H. The question whether electro-magnetic forces may not have demonstrable action on natural as well as polarized light has been lately taken up by Herr Sohncke. His guiding idea was this: It is known that two polarized light rays from the same source, meeting at a sufficiently acute angle, interfere most if they are polarized parallel, and not at all if polarized at right angles to each other. Now, natural rays of light from the same source behave, in regard to interference, quite like parallel polarized rays; and it seemed likely that two such rays would lose their power of interference if the direction of vibration (or greater ellipse-axis) of one of them were turned round by electro-magnetic forces 90 degrees relatively to the other, for in this case the two rays would behave like two polarized at right angles to each other. This was effected (in a way he describes). It appears that the same thing was done some years ago by Professor Abbe, using with natural light the natural rotation of a right and left quartz instead of electro-magnetic; and this before-unpublished method is also developed by Herr Sohncke, who describes a new interference experiment with natural light.

A New Arrangement of the Microphone.

Numerous modifications of the Ader microphone have been made by various inventors, one of the more recent being that of Herr G. Montanus, of Frankfurt, Germany, described lately in the *Elektro-tech. Rundschau*. As our illustration shows, the modification consists in freeing the vibrating diaphragm from restraint at its sides, so that



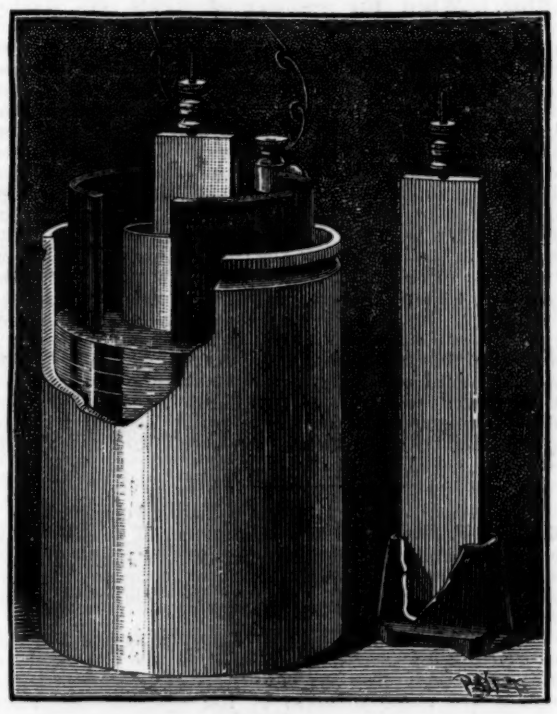
NEW ARRANGEMENT OF MICROPHONE.

the vibrations of the entire box are prevented. The plate carrying the carbons is supported at its four corners, and thus a free space is left around the diaphragm.

It will also be noticed that the small carbon cylinders have small vanes of flattened wire attached to them which maintain themselves in a vertical position, and thus prevent a rolling action in the carbons. By this means the disturbing, rustling sound is prevented, even if the microphone is spoken into in a very loud tone of voice.

A Novel Galvanic Battery.

Our illustration shows a modification of the Bunsen cell devised by M. Radiguet, which is said to add considerably to the value of the battery. It consists of an outer jar of enameled stoneware, containing an acid concentrated solution of bichromate of potash, a cylinder of carbon the head of which is paraffined and in the middle of which is placed a porous jar, the top and the bottom of



THE RADIGUET CELL.

which are also paraffined. This porous jar contains water acidulated with sulphuric acid in the proportion of 1 to 10. The zinc, which it also contains, is kept constantly immersed; the lower part is constantly in contact with mercury contained in a basin, the outer surfaces of which are inclined. This basin is of great importance, as it enables the zinc to remain immersed without being consumed, on open circuit.

If the mercury is simply poured into the bottom of the porous jars, besides the fact that a great quantity is required, owing to the convex form of the bottom, it is observed that after some hours of working, the mercury becomes rapidly coated with sulphate of zinc, and that this scum eventually adheres to the zinc and to the mercury and completely covers the latter. At the place where the zinc and mercury are in contact, a kind of film is formed which completely prevents all contact between the zinc and the mercury, and even hinders the mercury from penetrating into the pores of the zinc.

M. Radiguet's basin obviates this difficulty; the sulphate of zinc that is formed slipping over the outer surfaces, the mercury remains unaffected and in constant contact with the zinc. The acidulated water of the porous jars is changed after seven or eight hours. The same bichromate can be used for four charges of the porous jar, or for about thirty hours.

Failure to Send Dispatch.

The plaintiff, though an agent, made a contract to work for a manufacturer, and the agent who was to advise the plaintiff when he had completed the agreement, was required by plaintiff to telegraph the result to him. This he did, but the company neglected to send the dispatch, and the plaintiff sued them for the loss he suffered by losing the contract, as another firm was employed in his place, as he did not report for duty. The company denied that it was liable except for nominal damages, and the Supreme Judicial Court of Maine, in this case—Merrill vs. Western Union Telegraph Co.—so decided. Judge Haskell, in the opinion, said: "The contract was defeasible at the will of either party. How, then, can any substantial damage be measured? Had the engagement to employ the plaintiff been for a stipulated and definite period, not over one year, as it was not in writing, the plaintiff would have a right to demand damages which could be definitely measured or assessed. He would have then been entitled to enjoy the fruit of his labor during the time of his engagement, but this is an ordinary labor contract at a *per diem* rate, which could be broken at any time. The plaintiff must show that he suffered damages which resulted from the negligence of the defendant or he cannot recover."

The Telephone in South America.

In regard to recent telephonic happenings in South America, Mr. James H. Howard, the Vice-President and General Manager of the Tropical American Telephone Company, says:

Singularly enough, two very important consolidations of telephone interests have lately been accomplished in this company's territory, after a most bitter and expensive and persistent struggle for the supremacy between the owners of the Bell and Blake patents there, and would-be infringers or ignorers of these rights. I refer to the recent union of the River Plate Telephone and Electric Light Company, Limited, representing the "Gower-Bell" system, and the United Telephone Company, of the River Plate, Limited, controlling the Bell system. The former company has about 1,700 subscribers and the latter about 1,500 subscribers, making a larger exchange system, after consolidation, than in Boston, and nearly equal to New York.

In Brazil a union of four companies has been effected, and the Companhia Unido Telephonica do Brazil now controls all telephone business in the Empire of Brazil, with exchanges in nine cities, and with more under contemplation. The Tropical Company expects extensive orders as the result of these consolidations.

The State Department's Telegraph Bills.

The Washington correspondent of the Boston *Traveller* tells the following story of Comptroller Durham, of the Treasury Department: "Not long ago Secretary Bayard sent over the bills for the telegraphic service of the State Department. Comptroller Durham's eagle eye at once discerned that the bills were not accompanied by the telegrams. He called upon Mr. Bayard to produce them for his inspection. This, of course, was a reflection upon the Secretary's honesty, and it raised the ire of Delaware's favorite son. He sat down and ignored Durham completely. His reply was directed to the Secretary of the Treasury, and, it is said, was full of fireworks. He told him that Durham's interference was a little short of impertinence; that no person outside of the President had any right or business to become acquainted with the confidential diplomatic correspondence of the State Department, and that he should henceforth refuse to recognize the power of the Comptroller in the matter. The sequel was that Durham took backwater and the telegraphic accounts were approved in short order."

Canadian Telegraphs.

The Canadian Pacific Railway Company has not only put a road across the Dominion, but has undertaken to furnish new telegraphic facilities. Mr. Hosmer, the Superintendent of the Canadian Pacific Telegraph Line says: "We may look upon the establishment of a great international system of telegraphy, owned by the railway, as an accomplished fact. There are at present three wires between Montreal and Winnipeg. Two of these wires are used for railway purposes, the other is devoted to commerce, and at present time men are busy stringing a fourth wire, which will be direct. Of course, this work of putting up wires cannot, now while the snow remains on the ground, be done as rapidly as would be wished, and as will be done later on; still satisfactory progress is being made in the work, as it has been found that business re-

quires it. Additional wires are also being laid between Montreal and Ottawa, and as soon as the telegraphic system is fully completed on Canadian soil, connection will be made with the United States by the Baltimore & Ohio lines, and the great Stokes System, which also includes the Bankers and Merchants' telegraph lines, as well as a large number of independent lines. At present the Stokes system is being extended by wires being strung between St. Paul, Chicago, Baltimore, Washington, New York and Boston. This, when completed, will cover not only all the great commercial centres in the United States, but also rather more than 75 per cent. of the smaller points at present reached by the Western Union. Connection will also be made with the Atlantic cable system and when this is finally connected with the existing and projected line of the Canadian Pacific Railway that company can boast of perhaps the most thorough and complete system of telegraphy in the world." Mr. Hosmer says that at present it is not certain as to the exact date when the new system will be ready for commercial business, but it will certainly be some time during the summer.

An Electric Traveling Crane.

The Compagnie des Entrepots et Magasins Généraux in Paris have large warehouses in Roubaix, where the cotton bales arriving mostly from Australia and La Plata are stored before being forwarded to the different cotton mills. On account of the great fire risk no steam crane is permitted in the establishment, and the bales, which measure about 1½ cubic yards, and weigh half a ton each, had, until recently, to be hoisted and generally handled by manual labor. Now, the work is done by an electric traveling crane. The crane post is placed on a trolly, which runs on rails, and a rail fixed to the ceiling of the warehouse guides the upper end of the post. The jib of the crane can be raised or lowered, somewhat after the fashion of the cranes employed by builders, and thus the distance of the load from the post can be varied. The jib can also swing all round, and the bale can be deposited in any position covered by the sweep of the jib. On the trolly is fixed a small Gramme 4 horse-power dynamo, running at 900 revolutions a minute when fed with 15 ampères at 250 volts pressure. By suitable gear the dynamo, which is always kept running, can be made to hoist the load, advance the crane on the rails, swing the jib round, or raise or lower it. The current is conveyed to the crane by overhead sliding contacts. The generator is a 6 horse-power Gramme dynamo, running at 1,200 revolutions a minute, and the commercial efficiency of the whole system is said to be 60 per cent. Formerly ten men could handle 150 bales in 18 to 20 hours. The electric crane, attended by four men, does the same work in three hours.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
NEW YORK, April 26, 1886.

Some particulars were given recently in THE ELECTRICAL WORLD of the Kerite submarine cables that have been laid for the American Telegraph & Telephone Company between New York and Philadelphia. Two more of these cables—No. 72 submarine armored—have now been put down in the North River, each containing 3 No. 18 B. W. G. copper wires with $\frac{9}{32}$ Kerite insulation, and having as armor 18 No. 4 galvanized iron wire. Each cable is 6000 feet long.

The Kyle Electrical Manufacturing Company has moved to its new quarters, No. 45 Cortlandt street. Its new Seely open circuit battery is meeting with quite an active sale. The company will shortly offer several other specialties.

The Clifton Hard Rubber Manufacturing Company, 253 Broadway, is actively engaged turning out some electrical novelties that are about to be marketed, and in the manufacture of which its great facilities give it unusual advantages.

The Electrical Accumulator Company, of 15 Cortlandt street, moves to 42 Broadway on the 1st of May. I understand that the company is building an immense factory in Jersey, where it will produce its accumulators.

The Electrical Supply Company is busy filling orders for its Diamond battery. An officer of a large company using these batteries said to me last week: "I would not use any other battery for my work. Accidental closing of the battery circuit does not injure the battery, as it will recover its power, an unusual thing when open circuit batteries happen to be short circuited a few hours. The reason is that the battery contains no depolarizing mixture that will become destroyed on the recovery of the battery; and another good feature is the large carbon surface symmetrically arranged about the zinc."

I am sorry to note that at an early hour on the morning of April 27 a fire broke out in the organ factory of Hilborne L. Roosevelt, at No. 149 West Eighteenth street, where the Leclanché battery is also made. The firemen had the flames under control in a few minutes, but much damage was done to the stock by smoke and water. Mr. Roosevelt's son estimated the loss from $15,000 to $25,000. It is fully covered by insurance. Business will be carried on as usual.

W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
BOSTON, Mass., April 26, 1886.

The Chemical Electric Light & Power Company claims that by the use of Volta Pavia solutions in Fuller batteries now used by telegraph companies a saving of over 50 cents per quart cell per year can be made as against the present use and the labor involved in cleaning zincs and renewing potash solution. Several of the best residences in Boston are now using Volta Pavia cells for lighting with incandescent lamps. It is also claimed by this company that with its cells lights can be maintained in Pullman cars eight hours per day from Boston to San Francisco and return without touching thebatteries.

W. I. B.

PROVIDENCE, R. I., April 22, 1886.

Mr. V. A. Thomas, Superintendent of the Narragansett Electric Light Company, reports a steady increase in the number of both arc and incandescent lights furnished by his company, especially for commercial lighting.

The Rhode Island Electric Light Company, also of this city, is enjoying a very satisfactory business from patronage received for its large incandescent lights, known as the "Mogul" lamps. Mr. J. S. Drake, Superintendent of the company, reports a growing demand in this city for electric lights.

Volney W. Mason & Co., of this city, have just completed a full line of patent friction pulleys for double belts. These pulleys are all of their new style balanced segment, are six feet in diameter, and specially adapted for driving electric light dynamos from main shafting.

The American Supply Company, also of this city, is doing a very fair business in belting of all sizes. The company has on exhibition, at its salesroom No. 10 Exchange Place, an enormous belt, 182½ feet long, 34 inches wide, weighing 725 pounds, which was made from the hides of 60 steers.

The Dunnell Manufacturing Company, one of the largest mills in Providence, has just placed the patent friction clutches of Jas. Hunter & Son, of North Adams, Mass., on all the shafting used in its numerous buildings. This concern recently had an electric light plant of the Ball system installed on its premises, and reports same as giving thorough satisfaction.

The Rhode Island Telephone & Electric Company is having a very satisfactory run on its "Little Giant" battery and Wright cable clip. This company is entering quite extensively into the handling of electrical novelties and specialties.

W. I. B.

SPRINGFIELD, Mass., April 24, 1886.

The business of the Springfield Electric Light Company has changed hands. Mr. H. A. Cutter recently sold out his entire interest in the concern to his former employé—Mr. F. E. Julian. Hereafter the business will be conducted under the management of Mr. Julian, the name of the company remaining as before.

Mr. J. H. Burbank, electrician, also of this city, reports business as very fair in the electrical line. During the past season he claims to have found it impossible to keep pace with orders for fitting up residences and factories with electrical apparatus.

At the R. F. Hawkins Iron Works, business seems to be active, and especially so in the boiler department. This well-known company manufactures the Hennessy boiler, which is attracting attention and considerable patronage from promoters of electric lighting enterprises.

The Springfield Electric Light Company is undoubtedly one of the most successful enterprises of the kind in the country. It was established in 1881, and the system in use is that of the Thomson-Houston Electric Company. The present lighting capacity of the plant is 188 arc lights, and nearly that number is in constant use. At an early day more dynamos will be added to the equipment of the plant. Mr. J. J. Moore, the superintendent, informed me that for upward of fourteen months, during the regular hours for lighting up, none of the lamps have been out five minutes, and no accidents have occurred.

This plant has in use two magnificent Harris-Corliss engines of 125 horse-power each, and also a 75 horse-power Buckeye engine, which alternately, as the demand may require, run the dynamos with the aid of countershafting. When the commercial lights are started up early in the evening, the Buckeye engine—having a speed of 171 revolutions—attends satisfactorily to the load put upon it; but just as soon as the load becomes too great for it, by the starting up of additional dynamos, the work is transferred, by the help of two friction-clutch puileys, to the Harris-Corliss engine. This does not require any labor or trouble, and the mechanical arrangement of the friction-clutch pulleys is so simple and so easy to manipulate that a child can readily change the load over from one engine to the other. It often becomes necessary several times a night to change from the Buckeye to the Harris-Corliss engines and back again. The company has very few poles about the city, most of the wires being strung over structures on tops of buildings. Recently the company lighted up the Congregationalist Church with arc-lights which gave so much satisfaction that orders soon came in from several churches of other denominations. Three have already been supplied with both arc and incandescent lights from the station, and their congregations are very much pleased with the improved light derived, as compared with the gas formerly used.

W. I. B.

HOLYOKE, Mass., April 26, 1886.

Mr. Geo. F. Perkins, formerly manager of the New England Telegraph and Telephone Company for this section, recently resigned his position with said company and has opened a nicely stocked store for the sale of electrical goods.

Messrs. Buchanan, Bolt & Co., proprietors of the Holyoke Wire Works, are now catering to the electrical fraternity with their fine grade of brass and copper wires. The firm are manufacturers of the well-known "Fourdrinier" wires.

The R. H. Hill Machine Company manufactures the "Hercules" patent friction clutch, which is said to be very extensively in use among the great paper mills and other manufacturing concerns of Holyoke.

The Amherst Hydraulic Motor Company has recently entered into an arrangment with a number of wealthy Chicago gentlemen, whereby the product will hereafter be handled exclusively and agencies controlled by the latter under the name of the Exhaust Ventilator Company, American agents for the Amherst Hydraulic Motor. The president of the new company is L. G. Fisher, and the offices are No. 116 Dearborn street, Chicago, Illinois.

The Holyoke Electric Light Company is using the Schuyler system. It has seven dynamos, with a total lighting capacity of 190 lights, run by water power. The plant has a magnificent Buckeye engine of 375 H.-P., with requisite accessories for transferring same to the dynamos, if water power should at any time give out. The superintendent, S. B. Winchester, has made several valuable additions to the equipment of the plant, and it ranks second to none in the country. The demand in Holyoke for electric lights, both arc and incandescent, is constantly increasing, and the outlook is encouraging.

W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
PHILADELPHIA, April 26, 1886.

The Ridge Avenue Electric Railway, for which great promises were made a year ago, and which suddenly dropped out of sight, has reappeared with promises that new and fuller experiments will be made. Workmen are now engaged in readjusting the conduits, and another trial will soon take place. There is no reason why, with proper management, the proposed electric railway should not prove a great success. Ridge avenue is one of the main arteries of the northern part of the city, cutting diagonally across town, and the traffic there is enormous.

The status of the Bell Telephone Company has just been clearly defined by the State Supreme Court. Of course, the case will not rest there, but at present the judicial interpretation of the law by the highest court in the Commonwealth will be interesting. Some time ago the Baltimore & Ohio Telegraph Company applied to the Bell Telephone Company to place a telephone in the B. & O. office. The Bell Telephone Company declined to furnish one, on the ground that under a contract with the Western Union Telegraph Company it was precluded from extending its privileges to any other corporation in the same line of business. The Baltimore & Ohio Telegraph Company brought suit in the Court of Common Pleas, where Judge Arnold, in an exhaustive opinion, decided that such an arrangement as that referred to was in the nature of a monopoly, and that the Bell Telephone Company, being a common carrier, was obliged to furnish its instruments to the public without distinction and at a uniform rental. The Telephone Company thereupon took out a writ of error, and it was argued before the State Supreme Court by the most learned lawyers. On Monday last the Supreme Court affirmed the judgment of the lower court in the following brief opinion: "We have carefully examined the record in this case, and have given due consideration to the able argument of the counsel for plaintiff in error, yet we are not able to discover any error in the conclusion at which the learned judge arrived. His opinion contains a correct statement of the law and vindicates the judgment."

At the first meeting this season of the Electrical Committee of City Councils a sub-committee was appointed to prepare a general ordinance regulating the laying of underground wires. It may give us an insight as to what the city fathers think of the abolition of aërial lines when I state that at the same meeting of the same committee the chairman was instructed to prepare a resolution granting permission to the United States government to run a wire from League Island to the commandant's (Capt. R. L. Laws) quarters, Delancey place, and to use the city's poles.

At the same meeting a number of ordinances asking for electric lights in various parts of the city were laid on the table because there is no money available for that purpose.

The Committee on Science and Arts of the Franklin Institute has awarded a medal to Lucius J. Phelps, of New York, for his system of induction telegraphy. The Institute is, by the way, showing signs of its well-earned success. It has just appointed a committee to prepare plans for a new building. There is between $30,000 and $40,000 available for building purposes, aside from what might be obtained for the Seventh street property, where the Institute is now situated.

A curious and knotty telegraphic case arose in the courts here last week, in which Thomas G. Spear was charged with sending a forged telegram to Mrs. Mary W. Neff. The latter, who has a married daughter living at Pottsville, has been visiting Spear's mother, at his home. The young man is 18 years of age and romantic, and indulged in a flirtation with his mother's good-looking waiting maid. Mrs. Neff, who is a relative of the family, detected young Spear kissing the maid. She promptly informed his mother. Mrs. Spear reprimanded her son, and in the young man's heart arose bitter feelings concerning his parent's prim visitor. One morning Mrs. Spear's visitor received a telegram addressed to her announcing the sudden sickness of her daughter in Pottsville. It was signed by her son-in-law. Mrs. Neff went to Pottsville, where she found her daughter in perfect health. Mrs. Neff saw that she had been duped and, enraged beyond measure, she returned to this city and procured a warrant for the arrest of young Spear, who, she charges, sent the bogus telegram to get her out of his mother's house. He was held in $500 bail for his appearance at court.

On Friday last a new company with a capital of $1,000,000 filed articles of incorporation in Camden, N. J., under the title of "The Electro-Pneumatic Transit Company." The object of the organization is to "manufacture, sell and use machinery for the collection and distribution, by pneumatic and electrical means, of small packages and messages."

The State of Pennsylvania has just chartered the Edison Electric Illuminating Company, of Altoona, with a capital of $40,000, and the Keystone Light and Power Company, with a capital of $30,000. The latter company proposes to supply light and power by electricity to the city of Philadelphia.

Craig R. Arnold, the son of Judge Arnold, who, in the Common Pleas Court, gave the Bell Telephone-Baltimore & Ohio decision referred to above, has patented an incandescent light.

E. F. I.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
CHICAGO, April 24, 1886.

The Munson Belting Company issues a circular which contains some excellent testimonials as to the superiority of its belts for dynamo work. These testimonials are from some of the most prominent Western electric light companies, and the subscribers say they use no other make of belting. The Munson Company does not deal through the jobbers, but goes direct to the customer. By this method it is enabled to study the special wants of each particular user, and to furnish him a belt which is exactly suited to his needs. The growth of the electric light has induced it to make a study of the requirements for a satisfactory belt for this particular use, and the Munson "dynamo electric light belt" is the outcome. In this belt the stretch but not the elasticity is removed; there are no rivets, and a perfect evenness of heft is attained; and the result is that perfect motion which is so essential to a steady light. The fact that many of the Western com-

panies use no other belt speaks volumes in its favor. The company will be glad to send its new circular and catalogue to those writing for it. The main house is at 240–242 Randolph street, Chicago, and the Pacific coast branch is at 417–419 Market street, San Francisco.

Col. R. C. Clowry, Supt. Tubbs, Electrician Summers, Supt. Bristol, of Chicago, and Supt. Wallick, of Indianapolis, all of the Western Union Company, have been on an inspecting tour through Indiana and Ohio the past week.

The Logansport, Ind., street railway company wish to change their charter so as to allow them to use electricity or hot air as a motive power.

The New York Insulated Wire Company has opened a Western office at 75 E. Madison street, Chicago, under the management of Mr. J. H. Reid. This move is made for the purpose of bringing the company into closer relations with its large number of customers in the West using the Grimshaw insulated wires and cables. Mr. Reid is just the man for the position, having an extended acquaintance through the whole Western country.

Mr. J. R. Simpson, of the Westinghouse Electric Company, is about leaving for Kansas City, where he will make his headquarters hereafter. He has already closed a contract for 200 Westinghouse incandescent lights for the Kansas City Museum.

Mr. C. A. Brown, of the Western Electric Company, is in California, on a trip combining business and pleasure.

In last week's issue you had an account of the Council meeting in Indianapolis which ordered the Central Union Telephone Company to remove its poles from the streets within fourteen days. The Council has also voted unanimously in favor of admitting the West Telephone Company, and Mr. Rooker, from the judiciary committee, has reported an ordinance granting to the West Company the franchises taken from the Central Union, its principal provisions being as follows: (1) That such right shall be granted to the company whose directors are Solomon Claypool, John W. Murphy, W. C. DePauw, E. F. Claypool, Frederick Ostermeyer, Franklin Landers, D. M. Ransdell and Cas. Byfield. (2) No pole or tower shall be erected except where the council or board may dictate or city engineer approve. (3) The company is to have the right to attach its lines to all the fire alarm telegraph poles, providing that it shall keep them in repair and replace them with new ones whenever necessary. (4) Should the company cease to render the necessary service, or be permanently enjoined from using its telephone, its franchise shall be repealed, and all poles, lines, etc., be forfeited to the city. (5) The city shall have the right to use the top arm of all telephone poles for fire-alarm wires (6) The company shall furnish the city thirty telephones free from charge. (7) The city reserves the right to impose a special tax on the income of the company after the first year, and it shall not exceed 3 per cent. of the gross rentals. (8) All the telephones used by the company shall be manufactured in Indianapolis. (9) Active operations toward establishing the plant shall be begun in thirty days. (10) The company shall give a bond for any possible damages that may arise. (11) The city reserves the right to grant any other company the same franchise and to repeal this ordinance at any time. (12) No lease, sale or sublease of any rights granted under the ordinance shall be made to anybody else without the consent of the Council and board. (18) The maximum charge for telephone rentals shall not exceed $36 a year. (14) A violation of this ordinance shall cause a forfeiture of all the rights herein granted.

I shall await developments in Indianapolis with interest.

Col. S. G. Lynch, broker, 144 Lasalle street, Chicago, furnishes latest telephone quotations:

Bell of Mo.	$147@$150
Chicago	365@ 370
Central Union	48@ 50
Colorado	18@ 20
Cumberland	69@ 72
Great Southern	25@ 30
Great Southern Scrip, 65 cents on the dollar.	
Iowa Union	15@ 18
Michigan	64@ 66
Mo. & Kan.	52@ 54
Mo. & Kan. Scrip, 53 cents on the dollar.	
Rocky Mountain Bell	40@ 45
United	15@ 17
Wisconsin	108@ 110

W. A. K.

THE TELEGRAPH.

The San Juan Telegraph Company, of Ouray, Col., has been incorporated by Mr. J. Gillespie and others, with a capital stock of $5,000.

The Krupp Works.—At the present time the great Krupp works at Essen contain 40 miles of telegraph wire, with 35 stations and 55 Morse apparatuses.

The Standard Underground Cable Company, is about to begin the work of laying something more than 3½ miles of its Waring anti-induction 14-conductor cable for the Commercial Cable Company to replace the imported gutta-percha cable laid by the Commercial Cable Company last year. The new cables will be laid in Second avenue, New York, from 19th to 91st street.

Adverse to the Bucket Shops.—Charles E. Morgan, the Master in the suits of the "bucket shop" proprietors to have the Philadelphia Local Telegraph Company restrained from removing stock tickers from their offices, has filed a report adverse to the brokers. He holds that the business conducted by the plaintiffs is an illegal one, and that while the telegraph company is a common carrier, it is not bound to collect and furnish information as to the value of stocks to every person who applies.

A Deserving Case.—An appeal for help is being made by Mr. W. H. Adkins, manager of the Western Union office at Rome, Ga., on behalf of lineman N. J. Rhodes, of that place, whose house was carried away by recent floods. The house can be replaced on its proper site for a small sum, but furniture and clothing were destroyed. All contributions will be duly acknowledged. Mr. Rhodes is said to be a worthy and deserving man.

Train Telephony.—A dispatch from Chicago gives the following as the method of Cornelius Spillane, recently referred to, for telephoning with moving trains: "The invention is an extremely simple affair, consisting of a circuit wire resting on an insulated slab between the railway tracks. On this wire rests a circuit rod, made of a strip of metal having attached to it a movable metal roller, making a continuous connection between all stations and all trains on the line of the route. The return circuit is gained by means of a railwheel and axle. A wire runs through the train connecting all cars, so that conversation can be kept up from all parts of the train to all stations on the road and between all other trains on the line.

Telegraph Litigation.—It was decided by Judge Andrews, in Supreme Court Chambers, New York City, on April 26, that a stay of proceedings should not be issued in the suit of Gen. J. G. Farnsworth, receiver of the Bankers & Merchants' Telegraph Company, against the Western Union Telegraph Company for $2,000,000 damages on account of the cutting or seizure of the Bankers & Merchants' wires by the Western Union Company last July. Judge Andrews said that the trial should not be stayed in the Supreme Court pending the trial in the United States Circuit Court of the suit of Receiver Harland against Receiver Farnsworth for the separation of the American Rapid from Bankers & Merchants' wires. His theory was that, as the Western Union Company was not a party to the suit in the United States Circuit Court, it would not be bound by a judgment therein, but would be able to litigate in that court hereafter questions that could be settled in the Supreme Court suit. But as the United States Court had jurisdiction over Receiver Farnsworth, Judge Andrews said that the Western Union Company could apply to it for an injunction restraining him from prosecuting the Supreme Court suit.

THE TELEPHONE.

Newark, N. J.—The Domestic Telephone Company, of Newark, N. J., having sought to obtain a writ of certiorari to test the right of the Common Council of Newark to pass a resolution granting permission to the Citizens' Telephone Company to erect poles, a decision has been rendered favorable to the latter.

A New Company for Louisville.—A special dispatch of April 26 from Louisville says: "A telephone company is being formed in Louisville which will probably give the present monopoly some lively competition. Dr. F. H. Brown, of New York, arrived in the city last night, and is at Alexander's Hotel, his purpose here being to form the new company. He was preceded by several of his friends and agents, who have been canvassing among the business men here, and report a disposition on the part of capitalists to take stock in the new scheme. There has as yet been no company formed, but one will be organized in a day or two. The gentlemen likely to go into the enterprise are J. H. Linderberger, Carter Brothers, George Wicks, John D. Taggart and others. The Ohio Valley Telephone Company here has over 1,200 instruments in operation in this city. Accompanying Dr. Brown is Mr. J. B. Safely, who owns the right for the State of Indiana. He is anticipating a picnic in capturing the territory which the Bell Telephone Company has evacuated." Probably the weather will not be very favorable for the "picnic."

THE ELECTRIC LIGHT.

Seabright, N. J., will soon be lighted by the United States system.

Brockton, Mass.—The Edison Electric Illuminating Company, of Brockton, will pay 2 per cent. to stockholders of record May 1.

The Saratoga, N. Y., Gas Company has ordered a sixty arc light plant from the Indianapolis Jenney Company, the plant to be in operation on or before June 1.

The Shawmut Electric Manufacturing Company, of Kittery, Me., has been organized with a capital stock of $100,000. The President is Mr. W. D. Rich, and the Treasurer Mr. S. K. Bayley; offices, 17 Congress street, Boston.

Suing the New Orleans Exposition.—The Star Iron Tower Company having brought suit against the North, Central and South American Exposition, as a judgment creditor for large sums of money, the United States Circuit Court, New Orleans, has appointed receivers of the Exposition property.

The Bartholdi Statue is expected to be in readiness for lighting purposes by the fall. An entertainment to raise the small sum now needed was given on April 26 by the Twenty-second Regiment, at the Madison Square Garden. It was very successful. The Brush Company ran, as its contribution, the electric lights that added greatly to the brilliancy of the scene.

Dubuque, Ia.—J. K. Graves has sold the Steam Heating Works to a company which has been formed with a capital of $50,000. It is understood the works are put in by Mr. Graves at $25,000, and that a Chicago incandescent electric light company will operate both the light and the steam heating department.

A World's Fair Tower for Paris.—An iron tower, 984 feet high, is to be erected on the grounds of the coming Paris International Exhibition. The tower will be supported by four pillars which will be higher than the magnificent towers of the Cathedral of Notre Dame, which have an altitude of 295 feet. The structure will cost $1,000,000, and will be surmounted by a powerful electric light that will be visible, it is believed, as far as Dijon, which is 197 miles southeast of Paris.

Detroit, Mich.—The organization of the Edison Illuminating Company is complete, and the amount at which the enterprise is stocked is $250,000. It is intended to have a station in full operation by Sept. 1. The directors chosen at the stockholders' meeting are George Peck, Simon J. Murphy, Edward W. Voigt, George F. Moore, James E. Scripps, Samuel R. Mumford, J. R. McLaughlin, John R. Markle and C. D. Whitcomb. The following are officers of the company: President, George Peck; Vice-President, E. W. Voigt; Treasurer, S. R. Mumford; Secretary, J. R. McLaughlin.

The Hefner-Alteneck Standard for Light.—Dr. Bunte has recently experimented with Hefner-Alteneck's standard lamp, burning amylacetate by means of a solid wick 8.3 millimetres in diameter, and has added certain improvements by which the height of the flame can be more accurately adjusted. He has also observed that the purity or otherwise of the atmosphere in which the lamp burns has a very marked influence on the amount of light given out. Photometric rooms are generally so closed up from all sides that ventilation is imperfect. Special attention should be paid to this point, as the lamp will only give one standard candle if burning in a quiescent and pure atmosphere. The wick tube must be eight millimetres wide, and the total height of the flame must be forty millimetres, and the lamp should be left to burn at least for ten minutes before a measurement is taken.

APPLICATIONS OF POWER.

Electric Railways.—An ordinance has been passed granting the assent of the city of Independence, Kan., to the Kansas, Independence & Park Railway Company for the construction of an electric railway. Four electric street railways are projected for Detroit. The Ridge Avenue Electric Railway, Philadelphia, is to be carried to completion as soon as possible.

Aerial Navigation.—Dr. de Bausset, who has been for several years attempting to solve the problem of aërial navigation, has, according to a report from Chicago, just made a practical test that is of interest. The plan is to build a steel cylinder 270 feet long and 75 feet in diameter, with a 90-foot cone at each end, the entire length being 450 feet. Beneath this cylinder it is proposed to suspend a car, which will be about 120 feet long and carry the motor and a large number of passengers. The inflation process will be dispensed with, and the cylinder will be almost a complete vacuum. The inventor proposes to use electricity as a motor.

PERSONALS.

Mr. Charles E. Loew, one of the Electrical Subway Commissioners of this city, died last week. He was prominent in politics, and had also taken an active part in various successful business undertakings. The appointment vests in the Governor of the State, and up to the present time no successor has been named.

Mr. George L. Phillips has been elected President of the Central Union Telephone Company in the place of Col. R. C. Clowry, who has been compelled to resign by the pressure of his other duties in connection with the Western Union Company. The choice is an eminently wise one, Mr. Phillips being a man of unusual ability and acquirements, as well as having a thorough knowledge of telephony in all its details and departments.

MISCELLANEOUS NOTES.

The Eureka Electric Company, of Camden, N. J., has been formed by P. J. Fitzgerald and others, with a capital stock of $500,000.

New Open Circuit Gravity Battery.—There is now on exhibition at T. L. Kauffer's office, at 51 State street, Boston, a new open circuit gravity battery. One cell, size 6 × 8, has rung a vibrating bell continuously for 300 hours and still retains its strength, enabling it to light an automatic gas burner. An important feature of this cell is that the zinc is kept perfectly amalgamated, which reduces the local action to a minimum.

Platinum and Fluor.—M Moissan has made an interesting observation to the effect that red-hot platinum combines with penta-fluoride of phosphorus as well as with phosphorus itself. The platinum in the experiments was heated by an electric current, and when brought into an atmosphere of the penta-fluoride of phosphorus, it was seen to melt rapidly. Tried with tri-fluoride of phosphorus, a similar result was obtained.

The Westinghouse Machine Company, of Pittsburgh, have notified some of their employés that their request has been granted for an increase of wages to the amount paid previous to the reduction in November, 1884, equivalent to 11½ per cent. advance over the present wages. This, however, affects only the molders and a portion of the machinists. The firm is so crowded with orders that the works are running day and night.

Aging Wines by Electricity.—Dr. E. J. Fraser, of San Francisco, has been making exhibitions in that city of his patented process for aging wines by electricity. The liquors put under treatment have been tested by local wine experts, who thought that while the wine was made much smoother, the brandies and whiskies received the most benefit. The process appears to consist chiefly in winding wire around the casks and then passing a current through the coils. Dr. Fraser is now constructing tanks of 100 gallons capacity for repeating the work with large quantities of wine.

Suspension.—The suspension is announced of E. Remington & Sons, the well-known manufacturers of fire-arms, sewing-machines, typewriters, dynamos, etc., of Ilion, N. Y. The employés of the establishment are still at work in the numerous shops. Preparations are being made for a settlement with creditors, and it is thought that the company will be able to pay every dollar of indebtedness. At present about 700 men are employed, but at times the number of employés has been as large as 2,000. The plant is worth about $3,000,000. More than one-half of the families in the village are sustained by this establishment.

SPARKS AND FLASHES.

The Right Use of Conduits.—One of the New York dailies says that Mr. Dorsett is going to establish a factory near New York in order to be able to "flood the East with conduits." Mr. Dorsett evidently knows how to adapt means to ends. He sees that a hand hose would hardly be equal to the job.

Where the Associated Press Fails.—The Thomaston correspondent of the Rockland *Opinion* a few weeks ago, in mentioning that a man was lost overboard from the schooner Mary Sprague, says that if it had been a spar broken or anything connected with the vessel it would have been noticed and particularized, but being only a man his name was not even mentioned. I would like to ask the correspondent if he thinks the Associated Press very much to blame when he learns that his name was Zusammengetroffen Heidelberger, of Oberkreusberg.—*Lincoln (Me.) News.*

BUSINESS NOTICES.

The Shultz Belting Company, St. Louis, Mo., has published lately another edition of its catalogue of fulled leather belting. The product of the company has now been in use for ten years all over the country, and this catalogue gives details of it in all the forms under which it has won its high reputation. A large amount of usefu information will also be found in regard to the use o

belts, mechanical rules and problems, the management and care of steam boilers.

The Old Plan and the New.—Mr. James F. Morse, Vice-President of the Security Mutual Benefit Society of New York, 233 Broadway, has recently placed insurance to the amount of $100,000 on the lives of ex-Senator Arkell and his son, W. J. Arkell, proprietor of the Albany *Evening Journal* and the *Judge*. This insurance has been placed in the above-named and other leading companies doing business on the assessment plan. The annual cost of carrying it will be less than a thousand dollars. In the old life or level premium companies the cost would be four thousand five hundred dollars. The Arkells are among the leading business men of the country, and their indorsement of this method of life insurance will carry weight in the business community. The Security Mutual Benefit Society was organized in 1881, and we learn that the cost for assessments to a member forty years of age has been less than five dollars a year for each thousand dollars of insurance.

Hale's Honey,
The great cough, throat and lung cure, 25c., 50c. and $1.
GLENN'S SULPHUR SOAP heals—beautifies the skin; 25c.
GERMAN CORN REMOVER kills corns and bunions; 25c.
HILL'S HAIR AND WHISKER DYE, black and brown; 50c.
PIKE'S TOOTHACHE DROPS, will cure in one minute; 25c.
DEAN'S RHEUMATIC PILLS are a prompt, sure cure; 50c.

STOCK QUOTATIONS.

Telegraph, telephone and electric light quotations on the New York Stock Exchange, Boston Exchange and elsewhere are as follows:

Telegraph.—B. & M., b 2, a 3; Western Union, b 64, a 64¼.

Telephone.—Am. Bell, b 161½, a 162; Erie, b 27½, a 27¾; New England, b 33¼, a 33¾.

The Boston *Herald* of April 25 says:

There was a bearish feeling on Bell Telephone stock today. Legislative agitation is the point affecting telephone stocks at present. A point of more consequence is the monthly exhibit of instruments sent out and taken in, which shows steady growth. This means increased revenue for the parent company. Messrs. Cordley & Young say: "Telephones have been lifeless, and with no new features in their position except the passage to a first reading, by the Massachusetts House, of the bill restricting the ownership by parent companies in the stock of auxiliary companies to 30 per cent. of the capital of said companies, and a unanimous report of the Mercantile Committee that the American Bell be taxed in the same ratio as other corporations organized under Massachusetts laws."

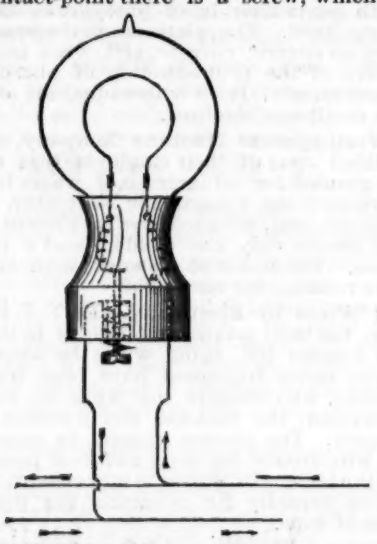
Electric Light.—No new quotations.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

PATENTS DATED APRIL 6, 1886.

10,711 (Reissue.) Hotel Annunciator and Fire-Alarm; Albert T. Hess, Des Moines, Iowa, Assignor to the Iowa Electrical Co, of same place. Substantially the same as original patent, 271,707, Feb. 6, 1883.

(1) 339,625, (2) 339,626, (3) 339,627. Telephonic Communication; Thomas B. Doolittle, Bridgeport, Conn. (1) Consists in establishing at certain principal stations at which the greater number of long double and single circuit lines centre, a testing-board, to which the actual terminals of all such lines are led, and at which the disposition of such circuits can be indefinitely varied, an operating switch-board at which the regular operations of interchanging, signaling and supervising can be carried on, the operating-board having suitable annunciators and spring-jacks in the circuit of loop or single wire extensions connecting with sockets on the test-board, and adapted to be connected through the intermediation of such sockets with any desired line or lines terminating at the test-board. (2) Consists in embodying in a single electric switch-board connecting cords and plugs placed at one side of the switch-board, each representing a single-line terminal, annunciators and connecting devices, each provided with one or more sockets for the reception of the said line-terminal plugs, and a series of pairs of conducting-cords and plug-connectors, arranged upon the other side of the switch-board and adapted to be used for connecting any two lines together for connection. (3) The plug is provided with a passage in the handle to receive the end of the conductor, which passage communicates with the contact-point of the plug. At the junction between this passage and the contact-point there is a screw, which may be



339,714. ELECTRIC SWITCH.

separate and independent, or may be formed of independently-movable portions of the plug, the end of the flexible conductor being placed under this screw.

339,672. Magneto Call; George A. Mason, Farringdon Road, Eng. As soon as the crank-handle is released the spring or contact-piece automatically returns to its original position, to short-circuit or cut out the coils of the magneto-armature.

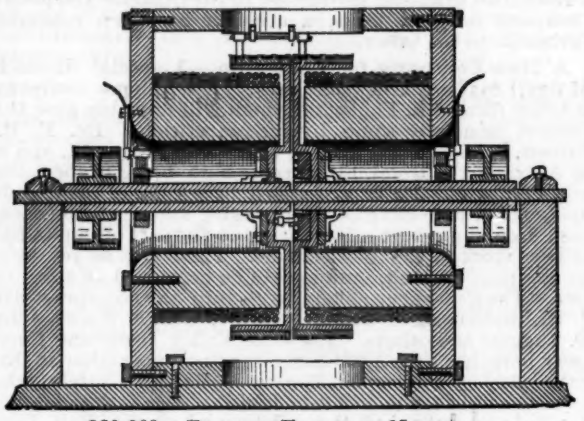
339 688. Synchronizing Device for Clocks; Chester H. Pond, Brooklyn, N. Y. As shown in the cut, it involves the addition of a controlling device operated to complete a circuit through the winding-motor and at the same time places a lever operating the synchronizing device in a position to be actuated by the mechanism which is moved by the motor. As soon as the operation of the motor has placed the hands in position to indicate the correct time, a shunt-circuit is formed around the electro-magnet, and thereby the parts are restored to the original condition.

339,706. Exhibiting Device; William T. Smith, Providence, R. I. Consists of a coin-tube, an oscillating lever provided with a coin-receiver to receive the coin from said tube, combined with a rotating shaft, a motor for same, a flier connected with the rotating shaft, and a stop-lever in operative connection with the oscillating lever and adapted to engage the flier, combined with an electric circuit, a circuit-controlling device, and one or more lamps in said circuit.

339,714. Electric Switch; Elihu Thomson, Lynn, Mass. The electrical connections are shown in the cut.

339,718. Individual Electric Signal; Ernest P. Warner, Chicago, Ill., Assignor to the Western Electric Co., same place. Consists of the swinging weight or shutter, which is raised by the clock-train during each revolution to a point where it is supported as long as the starting-magnet remains unenergized, the superfluous energy of the motor being thus stored as potential energy, while the weight remains elevated. The entire work of the electro-magnet consists solely in withdrawing the support from this swinging weight, which then falls forward upon the detent of the clock-train, releasing the detent and permitting the clock to start.

339,745. Telephone Transmitter; Daniel Drawbaugh Eberly's Mill, Pa., Assignor to the People's Telephone Company. He applies a body of soft material, such as cotton, to the rear of the diaphragm, and two inclined electrodes connected by a piece of carbon in the form of a cylinder.



339,839. DYNAMO-ELECTRIC MACHINE.

339,754. Spatula and Illuminator; Augustus R. S. Foote, Washington, D. C. Consists in combining with the substantially flat blade or spatula, adapted to bear upon and confine the tongue, an electric lamp seated within its inner or forward end, the lamp serving to illuminate the throat, while the blade serves, in addition to its ordinary function, as a support for the lamp and as a shield to prevent the passage of the light-rays from the lamp directly to the eye of the operator.

339,766. Telephonic Apparatus; Henry N. Hastings, Lynn, Mass. He combines with a telephone, letters or words and a different figure for each word, to insure accuracy in the transmission of speech.

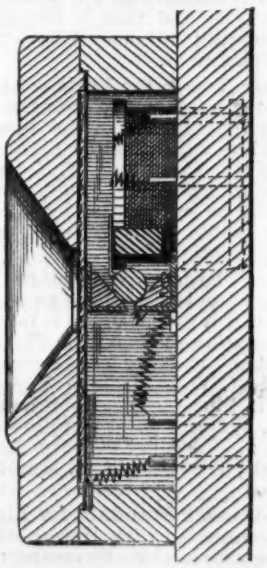
339,908. ARC LAMP.

(1) 339,772. Unipolar Dynamo. (2) 339,773. Dynamo Compensating Resistance; Carl Hering, Philadelphia, Pa., Assignor of one-half to Charles H. Banes, same place.

(1.) He multiplies the discs to obtain greater electromotive force.

(2.) He places carbon in circuit with shunt field coils, and allows the former to become heated.

339,777. Composition for Wires; John Howe, Lowell, Mass. Consists of cotton-seed oil, asphaltum, rosin, paraffine, wax and Venetian turpentine.



339,745. TELEPHONE TRANSMITTER.

339,787. Covering Wires; Edward D. Kendall, Brooklyn, N. Y. Consists of wax tailings, chicle, sulphur and oil.

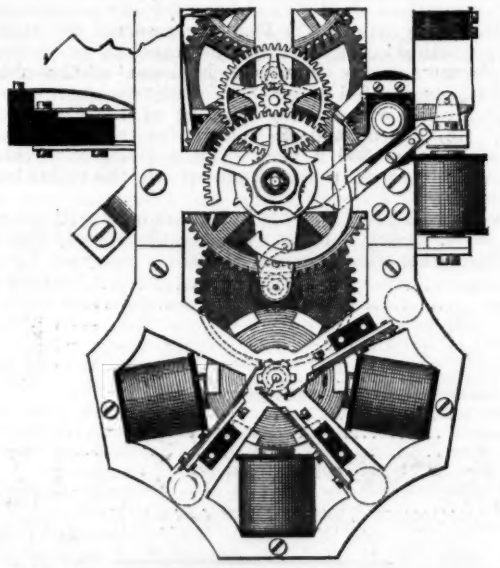
339,826. Steam Engine Governor; Axel O. Tengvall, New York, N. Y. Consists of a throttle valve adapted to control the quantity or pressure of the fluid or gas from which power is derived, which valve is operated automatically by a number of independent electro-magnets, whose armatures are attached to adjustable levers connected with the valve-rod, and to which currents of electricity are communicated through a series of switches which are worked automatically.

339,839. Dynamo; Charles Batchelor, New York, and Henry E. Walter, Clifton, N. Y. As shown in the cut, the field-magnet consists of two hollow cores, wound with coils, and each secured to an end-plate. These plates are the ends of a hollow shell, which shell forms the yoke of the magnet. One shell is provided with openings to admit air and to make it lighter. The other shell is supported upon a bed-plate. The armature or inductive body consists of rotating discs.

339,844. Underground Conduit; John Beeler, Cincinnati, O., Assignor of one-third to Elijah Coombe, same place. Consists of a tube located in the gutter of the street, the inner side of the tube being provided with hand-holes, and covered boxes located at suitable intervals in the curb and affording access to the interior of the tube through the hand-holes.

339,888. Electric Valve; Frank A. Hinds, Watertown, N. Y., Assignor to Hinds, Moffett & Co., same place. Consists in the improved apparatus where the gate is closed by means of a weighted rope operating a drum, which is released by an apparatus having suitable dogs and means for releasing them, the dog which starts the releasing apparatus being operated by breaking or closing an electric current.

339,908. Arc Lamp; David B. MacDonald and Hannibal W. Woodman, Hamilton, Canada. As shown in the cut, an infusible substance is placed between the electrodes, and all other operating mechanism is dispensed with.



339,688. SYNCHRONIZING DEVICE FOR CLOCKS.

339,909. Convertible Telegraph Key; James A. Maloney, Washington, D. C. Consists of an improvement upon patent 336,653, Feb. 23, 1886, granted to the above and A. G. Johnson jointly.

339,942. Electric Railway Circuit; Sidney H. Short and John W. Nesmith, Denver, Colo. Includes a conductor composed of sections properly insulated and adapted to the contact of moving current-gatherers, the sections being connected by automatically-closing contact-pieces on said ends, and closing the circuit by contact with each other, in combination with an insulating bar or like device carried on the car or other vehicle adapted to separate the circuit-closers at the ends of the sections, and thus open the circuit and hold it open while passing, the said bar having contact-surfaces in circuit with an electric receptive device on the car.

339,960. Signaling Apparatus; John C. Wilson, Boston, Mass. Consists of a signal-box containing a break-wheel and a polarized signaling-instrument and device for interposing the latter in the circuit after the signal has been transmitted by the break-wheel, combined with a battery-reversing instrument located at the station where the signal of the break-wheel is received for operating the polarized signaling-instrument at a sub-station.

340,028. Telephone Switch; John A. Blattan and George A. Boydon, Baltimore, Md. Mercury, by its gravity, closes or opens the circuit according to the position of the telephone.

340,046. Underground Conduit; Daniel N. Hurlbut, Chicago, Ill. Consists of a section having a flaring or bell-shaped end, the other section constructed to enter said end, the meeting edges of the sections being provided with flexible packings, and an annular space or pocket being formed between the two sections containing a flexible or plastic filling.

340,065. Arc Lamp; Simon H. Stupakoff, Hartford, Conn. Balls are combined with the carbon holder to produce retaining friction.